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Comprehensive Program
1992 - 1997

Final Environmental Impact Statement

Volume II

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April 1992

PROPOSED OUTER CONTINENTAL SHELF NATURAL GAS AND OIL RESOURCE MANAGEMENT COMPREHENSIVE PROGRAM FOR 1992-1997 ENVIRONMENTAL IMPACT STATEMENT

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IV

Environmental Consequences

- *Environmental Impacts of Alternatives*
- *Unavoidable Adverse Environmental Effects*
- *Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity*
- *Irreversible and Irretrievable Commitment of Resources*
- *Unlikely Accidental Events*

c. Cumulative Case

BASIC ASSUMPTIONS: The cumulative analysis considers impacts to the environment when the proposed action is added to past, present, and reasonably foreseeable future actions or activities. To provide a framework for the cumulative impact analysis, the past, present, and future actions or proposals have been divided into two categories: non-OCS and OCS natural gas and oil activities.

Non-OCS activities are those activities which are not associated with the Federal OCS natural gas and oil program (e.g. commercial fishing). The OCS activities are those activities which are associated with existing or proposed exploration and development of existing leases; exploration and development assumptions concerning the areas under consideration for lease; and in some planning areas, potential leasing activity as the result of subsequent OCS programs.

Assumptions for OCS activities in the cumulative case take into account the regulatory requirements for identifying actions to be considered in the analysis, as well as the President's June 26, 1990, announcement regarding the OCS program. The cumulative case assumptions were also based on whether a planning area is producing OCS natural gas and oil, is a frontier area (area without current production), or currently has some level of exploratory activity.

- It is assumed in the Central and Western Gulf of Mexico Planning Areas that exploration, development, and production activities would occur as the result of future OCS programs.
- In frontier areas, with the exception of the Beaufort Sea and Chukchi Sea Planning Areas, no assumption is made concerning future leasing and subsequent development in future OCS programs.
- In the Beaufort Sea and Chukchi Sea Planning Areas, it is assumed the activity from future leasing in subsequent OCS programs is limited to exploration only.
- No assumption is made concerning future leasing and subsequent development in future OCS programs in the frontier areas (northern California, and the eastern Gulf of Mexico south of 26° N latitude) identified in the President's announcement of June 26, 1990.
- In the Southern California Planning Area, no assumption is made concerning leasing and subsequent development in future OCS programs.

OCS ACTIVITIES AND ASSUMPTIONS

RESOURCE ESTIMATES: The U.S. Geological Survey's Crovelli Model was used to aggregate the resource estimates for the cumulative case. This model provides a more reasonable indication of the likelihood of natural gas and oil activities occurring within a region or subregion over the life of the proposed program.

As indicated earlier (see Section IV.D.1.a), conditional resource estimates are not directly comparable between planning areas since they are generally based on different marginal probabilities. This probabilistic model aggregates the hydrocarbon distributions for each planning area while honoring the marginal probabilities of the distribution curve. The Crovelli Model, therefore takes into consideration the different marginal probabilities of each planning area when calculating the cumulative (regional or subregional) resource estimates.

The cumulative resource estimates for each region or subregion (see Table IV.D.1.c-1) take into consideration leased resources and reserves, resources assumed to be leased as the result of sales associated with the new proposed program, and future sales associated with subsequent OCS programs (see assumptions above).

Table IV.D.1.c-1. Resource Estimates — Cumulative Case

SUBREGION OR PLANNING AREA	OIL (BBO)	GAS (TCF)	MPHC
GULF OF MEXICO REGION			
Western Gulf of Mexico[1]	1.39	27.46	1.00
Central Gulf of Mexico[1]	5.82	54.00	1.00
Eastern Gulf of Mexico[1]	0.08	1.24	1.00
ALASKA REGION			
Arctic Subregion[2,3]	5.42	—	0.32
Bering Sea Subregion[2,4]	1.37	—	0.03
Gulf of Alaska Subregion[2,5]	0.85	—	0.04
PACIFIC REGION			
Southern California[1]	1.59	2.92	1.00
ATLANTIC REGION			
Mid- and South Atlantic[2]	0.09	2.64	0.64

1. Includes leased and unleased resources, and reserves.
2. Includes leased and unleased resources.
3. Aggregation of the leased and unleased resources from the Beaufort Sea, Chukchi Sea, and Hope Basin.
4. Aggregation of the leased and unleased resources from Norton, Navarin, St. Mathew-Hall, and St. George Basins.
5. Aggregation of the leased and unleased resources from Cook Inlet and Gulf of Alaska.

BBO - Billion Barrels of Oil
TCF - Trillion Cubic Feet
MPHC - Marginal Probability of Commercial Hydrocarbons

EXPLORATION AND DEVELOPMENT ACTIVITIES AND ASSUMPTIONS:

Gulf of Mexico Region. The Federal offshore natural gas and oil program in the Gulf of Mexico Region dates back to 1954. The Region has offered over 566 million acres in 62 sales since 1954.

Existing OCS offshore infrastructure related to the gas and oil industry is highly concentrated in the central and western Gulf of Mexico. In the central Gulf alone, over 3,200 platforms and 26,000 km of pipeline are in place; whereas, in the western Gulf over 360 platforms and 4,300 km of pipeline are in place. To this date, only OCS exploration activities have taken place in the eastern Gulf of Mexico.

The major types of offshore activity in the area include exploration, delineation, and development drilling, and emplacement or removal of platforms and pipelines. The drilling trend in the Gulf of Mexico has been changing. Exploratory drilling now represents over 58 percent of the wells drilled.

The central and western portions of the Gulf of Mexico have one of the highest concentrations of gas and oil activities in the world. This level of activity is accompanied by extensive development of onshore service and support facilities. The onshore infrastructure is highly concentrated in the coastal areas of Louisiana and eastern Texas, and to a lesser extent, along the south Texas coast and east of Louisiana to Mobile, Alabama. Major onshore infrastructure includes gas processing plants, navigation channels, oil refineries, pipelines and pipeline landfalls, pipecoating and storage yards, platform fabrication yards, separation facilities, service bases, and terminals.

It is expected that the vast majority of the onshore service, support, and hydrocarbon processing facilities already in existence will be sufficient to explore, develop, and produce gas and oil resources projected to result from prior, proposed, and future sales. It is assumed, for analysis purposes, that there will be about a 90-percent use of these facilities in support of future OCS operations.

Alaska Region. A total of 15 sales have been held within the Alaska Region. The USDOI has leased 1,281 blocks (8.2 million acres). To date, all postlease activities in the Alaska Region have been exploratory in nature.

Several oil prospects (Galahad, Belcher, Klondike, Burger, and Popcorn) in the Beaufort and Chukchi Seas have been identified. Plans for exploring these prospects have been proposed or have been completed.

In the 1983-1984 winter drilling season, Amerada Hess Corporation discovered oil on leases acquired during the 1979 joint Federal-State lease sale held in the Beaufort Sea. In early 1989, Amerada Hess submitted a proposed unit agreement for the Northstar/Seal Island Discovery to the Alaska Division of Oil and Gas for their review. This unit agreement covers five State and two Federal leases. The current estimate of recoverable reserves for the area is 150 MMbbl of oil.

Pacific Region. The offshore program in the Pacific Region dates back to 1963. A total of 11 lease sales have been held since that time, and currently there are 123 active leases. Most of the postlease activities have taken place on leases in the Southern California Planning Area. There are 1 central processing and 20 production platforms installed in the Region, as well as a floating storage and treating vessels.

Twenty-four offshore fields are located in five major areas of the Southern California Planning Area: Point Arguello/Gaviota, Santa Ynez/Las Flores Canyon, Pt. Pedernales/Lompoc, San Miguel/ South Nipomo Mesa, and Santa Clara/Ventura.

Atlantic Region. There have been nine OCS lease sales in the Atlantic Region. There are 129 active leases in the Mid- and South Atlantic Planning Areas. The exploration of the Atlantic Region resulted in 46 exploratory wells and 5 COST wells; however, none of the wells have resulted in a discovery of commercial quantities of oil or gas.

The submission of an exploration plan (EP) for a single well to be drilled at block 467 offshore North Carolina by Mobile Offshore Exploration and Producing Southeast Inc. represents the extent of current industry activity in the Atlantic Region. As of March 12, 1991, the North Carolina rejection of the Mobil EP for inconsistency with the State Coastal Zone Management Program is under appeal by the Secretary of Commerce.

OCS EXPLORATION AND DEVELOPMENT ASSUMPTIONS: To provide a basis for the analysis of future OCS exploration and development activities, hypothetical scenarios were developed (see Tables IV.D.1.c-2 and IV.D.1.c-3) using the base case exploration and development assumptions (Section IV.D.1.a).

TRANSPORTATION AND MARKET ASSUMPTIONS: The basic assumptions concerning how oil and gas production will be transported to shore and whether production will be transported by tanker or pipeline to markets are identical to the base case (see Section IV.D.1.a).

OIL SPILL ASSUMPTIONS: The base case assumptions concerning the assumed number of oil spills (see Section IV.D.1.a) were used to generate Tables IV.D.1.c-4; IV.D.1.c-5 and IV.D.1.c-6 for the cumulative case analysis. Assumptions concerning the assumed number of non-OCS oil spills used to generate Table IV.D.1.c-7 is contained in Section IV.D.1.c — Non-OCS Activities and Assumptions.

Table IV.D.1.c-2. Exploration And Development Activity — Cumulative Case

Planning Area	BBOE	MP_{HC}	Exp./Del. Wells (No.)	Dev./Pro. Wells (No.)	Platforms (No.)	Platform Removals (No.)	Years Of Activity
Western Gulf of Mexico	6.28	1.00	5520	2450	150	473	1992-2036
Central Gulf of Mexico	15.42	1.00	5950	5130	340	2625	1992-2036
Eastern Gulf of Mexico	0.30	1.00	580	200	28	22	1992-2036
Arctic Subregion	5.42	0.32	72	723	12	12	1994-2021
Bering Sea Subregion	1.37	0.03	37	300	6	6	1995-2025
Gulf of Alaska Subregion	0.85	0.04	24	140	3	3	1996-2021
Southern California	2.11	1.00	48	570	17	21	1998-2030
Mid- and South Atlantic	0.56	0.64	50	160	9	9	1995-2024

MP_{HC} - Marginal Probabilty Of Commercial Hydrocarbons
BBOE - Billion Barrels of Oil Equivalent

Table IV.D.1.c-3. Offshore and Onshore Infrastructure — Cumulative Case

Planning Area	Platforms (No.)	Oil and Gas Pipelines[3,6,7,8] (No.)	Oil and Gas Pipelines [7,9] (Miles)	Pipeline Landfalls (No.)	Shore Bases/ Support Facilities (No.)
Western Gulf of Mexico	150	–	2230	4	4[1]
Central Gulf of Mexico	340	–	3140	4	2[2]
Eastern Gulf of Mexico	28	–	545	–	–
Arctic Subregion	12	–[4]	615	4	3[5]
Bering Sea Subregion	6	–[4]	–	–	2[5]
Gulf of Alaska Subregion	3	1	125	2	2[5]
Southern California	17	16[11]	120	–[12]	–[13]
Mid- and South Atlantic	9	4	700	4	7[10]

1. Gulf of Mexico Region - additional support facilities: 4 new marine terminals.
2. Gulf of Mexico Region - additional support facilities: 1 new marine terminal and 1 new pipeline yard.
3. Alaska Region - oil pipelines only.
4. Alaska Region - offshore gathering system.
5. Shorebases can include tank farms, docks, air bases, utilities, supply depots and personnel quarters.
6. Pacific Region - total number of oil and gas pipelines.
7. Pacific and Gulf of Mexico Regions - oil and gas pipelines are layed along the same pipeline corridor.
8. Atlantic Region - gas pipelines only.
9. Atlantic Region - total pipeline miles includes gathering and trunk lines.
10. Atlantic Region - additional support facilities: 3 new gas plants, two supply bases, and 2 new heliports.
11. Pacific Region - assumes one additional pipeline is required after 1/1991 to develop OCS reserves will be installed in the northern Santa Maria Basin; if not one additional pipeline will be required to develop OCS resources in the 87 tracts.
12. Pacific Region - existing and currently planned but unbuilt, offshore pipelines are assumed to accommodate development and production on the 87 tracts.
13. Pacific Region - existing and currently planned but unbuilt, onshore facilities are assumed to accommodate exploration, development and production on the 87 tracts.

Table IV.D.1.c-4. OCS Oil Spill Assumptions — Cumulative Case

Planning Area	Assumed Oil Spills (1,000 bbl or greater) Platform (Nos.)	Pipeline (Nos.)	Tanker (Nos.)
Western Gulf of Mexico	1	1	–
Central Gulf of Mexico	3	4	–
Eastern Gulf of Mexico[1]	–	1	–
Arctic Subregion	3	4	7
Bering Sea Subregion	1	1	4
Gulf of Alaska Subregion	–	1	1
Southern California	1	1	–
Mid-and South Atlantic[1]	–	–	1

1. Although the estimated mean number of spills was 0.11 for the Eastern Gulf of Mexico and 0.16 for the Atlantic Region, for analysis purposes a spill was assumed to occur.

Table IV.D.1.c-5. Oil Spill Probabilities — Cumulative Case

Planning Area	Oil (BBO)	MP_{HC}	Probability of 1 or more spills occurring: 1,000 bbl or greater	10,000 bbl or greater
Western Gulf of Mexico	1.39	1.00	83%	46%
Central Gulf of Mexico	5.82	1.00	**%	93%
Eastern Gulf of Mexico	0.08	1.00	10%	5%
Arctic Subregion	5.42	0.32	**%	**%
Bering Sea Subregion	1.37	0.03	**%	82%
Gulf of Alaska Subregion	0.85	0.04	96%	66%
Southern California	1.59	1.00	87%	48%
Mid-and South Atlantic	0.09	0.64	15%	8%

**probability of one or more spills occurring is greater than 99.5%

BBO - Billion Barrels of Oil .

Table IV.D.1.c-6. Small Spill Assumptions — Cumulative Case

Planning Area	Assumed Small Spills $>1\leq50$ bbl[1]	Assumed Small Spills $>50<1{,}000$ bbl[2]
Western Gulf of Mexico	188	7
Central Gulf of Mexico	786	29
Eastern Gulf of Mexico	11	1
Arctic Subregion	1375	56
Bering Sea Subregion	347	14
Gulf of Alaska Subregion	216	9
Southern California	116	4
Mid-and South Atlantic	23	1

Small Spills Rates per billion bbls of oil produced:

1. Gulf of Mexico Region - 135; Alaska and Atlantic Regions - 253.63; Pacific Region - 72.65
2. Gulf of Mexico Region - 5; Alaska and Atlantic Regions - 10.25; Pacific Region - 2.14

Table IV.D.1.c-7. OCS and Non-OCS Oil Spill Assumptions — Cumulative Case
Assumed Location of Tanker Spills

Location of Tanker Spills	Assumed Tanker Spills[1] (Nos.)		
Region/Subregion and Planning Area	OCS	TAPS	FOREIGN
Gulf of Mexico Region	–	2	63
Alaska Region			
Arctic Subregion	1	–	–
Bering Sea Subregion	4	–	–
Gulf of Alaska Subregion	2	6	–
Pacific Region	5	5	5
Atlantic Region	1	-	13

1. 1,000 bbl or greater.

NON-OCS ACTIVITIES AND ASSUMPTIONS

This section describes the major non-OCS projects and proposals and existing onshore gas and oil infrastructures which are part of the existing environment or are reasonably foreseeable future actions. Only general assumptions concerning the timing and location of non-OCS activities that may contribute to the cumulative impacts can be made. The following is a general discussion of those non-OCS projects and proposals that are relevant to the cumulative impact analysis for several resources. Non-OCS projects and proposals which may affect only one or a few resources are identified in the cumulative impact analysis for that resource.

DREDGING AND MARINE DISPOSAL:

Dredging Operations. Dredging operations for channel construction and maintenance, pipeline emplacement, access to support facilities, creation of harbor and docking areas, and siting for onshore facilities in coastal areas have environmental effects that range from transitory to long term.

Disposal Sites. A variety of materials have been dumped in OCS waters, including dredge spoils, low-level radioactive wastes, obsolete munitions, and industrial and municipal wastes.

Ocean dumping of acceptable waste material is authorized under Title I of the Marine Protection, Research and Sanctuaries Act of 1972, as amended (33 U.S.C. §1401), and the Federal Water Pollution Control Act, as amended (33 U.S.C. §1251). The USEPA administers the designation and management of ocean disposal areas and permits for dumping of all acceptable wastes except dredged materials. The dumping of munitions, including undetonated explosives, chemical munitions, and radioactive wastes, has been prohibited since 1970. In January 1983, the Act was amended to prohibit ocean disposal of radioactive material for 2 years (January 1983 through January 1985); the ban was then extended indefinitely. In November 1988, the Act was amended (Ocean Dumping Ban Act) to prohibit the ocean dumping of all sewage sludge and industrial wastes by December 31, 1991.

Gulf of Mexico Dredging and Disposal Sites. The USEPA has one designated deep-water disposal area in the Gulf of Mexico. The site is designated for the incineration of hazardous wastes, should any such permits be issued in the future; there are no incineration permits active at the present time. The incineration program may be considered inactive at the present time, but the disposal area has not been officially re-designated. Dredged material disposal sites, mostly located in State waters, are used for the disposal of dredged material from the Army Corps of Engineers (COE) channel dredging programs.

Snake River Dredging Project. The Snake River which enters the Norton Sound at Nome, Alaska, is dredged annually. Approximately 13,000 cubic yards of sediment are removed each year and deposited about 1/2 mile east of the mouth of the river. Data that have recently been made available have led the USEPA to review the decision to use this offshore disposal site. Nome Harbor sediments were tested by the USEPA in 1989 and were found to contain measurable levels of a number of chemical constituents. The COE and USEPA are reviewing the new information with regard to suitability of the material for continued ocean disposal.

Pacific Region Disposal Sites. Presently, there are 38 designated historic and active dump sites located off the southern California coast.

Atlantic Region Disposal Sites. On the Atlantic OCS, there are approximately 38 dredged material, 14 industrial waste, 6 sewage sludge, 19 munitions, and 24 nuclear waste material disposal sites. Of these, 31 dredged material sites and 1 sewage sludge site are active. All radioactive disposal sites and munitions and industrial disposal sites are closed to further dumping.

COMMERCIAL AND RECREATIONAL FISHERIES: Commercial and recreational fisheries on the OCS are discussed in Chapter III for each Region. Commercial fisheries employ a variety of methods to harvest fish. These methods include diving, longlines, trawls, trolls, purse seines, set and drift gill nets, and traps and pots.

Alaskan Groundfish Industry. Based on model runs of the Institute of Social and Economic Research, Rural Alaska Model, it is assumed that there would be about a 1-percent growth rate in the groundfish industry, which would affect the communities of Homer, Kodiak, and Seward. Homer is expected to develop one groundfish processing plant in the mid-1980's; by the end of the study period (2010), Kodiak should develop two groundfish processing plants. By the end of the study period, a fleet of approximately 40 ships is projected to originate from Kodiak.

SUBSISTENCE AND HUNTING ACTIVITIES: Subsistence hunting and fishing are important from both a cultural aspect and in terms of providing a major food source for Native, rural Alaskans, and Native Americans and ethic groups in the Pacific Region. A complete description of subsistence activities is presented in Section III.B.3 for the Alaska Region and III.C.3 for the Pacific Region.

COASTAL AND COMMUNITY DEVELOPMENT:

Mississippi River Flood Control. Alterations in the hydrology of the Mississippi River basin have caused declines in sedimentation rates and have contributed to marsh deterioration in the coastal wetlands of Louisiana in recent decades. Coastal marshes appear to expand or diminish in areal extent according to the amount of sediment available, and sedimentation can be a limiting factor controlling marsh growth. In a natural system, overbank flooding is a mechanism of introducing sediment-laden waters into adjoining wetlands. Flood control levees on the lower Mississippi River and its distributaries have contributed to wetlands loss in the Gulf because levees eliminate overbank flooding and prevent the distribution of alluvial sediments across the Mississippi River Delta.

Submergence of Wetlands. The submergence of coastal wetlands in the Gulf of Mexico Region contributes to a loss of 13,000 ha/yr in coastal Louisiana. If submergence occurs faster than the rate at which sedimentation and peat formation can build the marsh surface upward, marsh survival is threatened by waterlogging and ultimate flooding. The submergence rate that is critical for the survival of wetlands in different parts of the Gulf has not been determined.

Submergence in the Gulf is occurring most rapidly along the coast of Louisiana. The submergence rate in Louisiana has two components: the rate of rise of eustatic sea level and the rate at which the land itself is subsiding beneath the sea. During this century, the eustatic rate of rise of sea level along the Louisiana coast has been relatively constant at 2.3 mm/yr (23 cm/century), although the rate has varied from a sea level decrease of 3 mm/yr to a maximum increase of 10 mm/yr over decade-long periods (Turner and Cahoon, 1987). Depending on local geologic conditions, the subsidence rate varies across coastal Louisiana from 3 to 10 mm/yr. The primary natural processes responsible for land subsidence include geosynclinal downwarping, compaction, dewatering, and the horizontal flow of recent sediments. Anthropogenic factors, such as fluid withdrawals from oil and gas reservoirs, appear to have only a localized influence on subsidence directly above the reservoirs. In coastal Louisiana, the total area of wetlands with a subsidence potential related to fluid withdrawals greater than 10 cm is about 400 km^2 (Turner and Cahoon, 1987).

Submergence of wetlands is also considered a factor in erosion of wetlands in the western portion of the Gulf of Mexico (White et al., 1985; 1986). In addition to submergence associated with eustatic sea level rise, submergence along the Texas coast has been compounded in some areas by human induced land subsidence from groundwater withdrawals (Ratzlaff, 1980) and natural compactional subsidence (Swanson and Thurlow, 1973).

Gulf of Mexico Region Habitat Loss. Several kinds of major natural processes create particular problems in the coastal zone. These include the following: hurricanes which, through high and intense flood surges, may breach barrier islands and dunes, flooding low-lying coastal areas; shoreline erosion under storm and normal conditions; inland flooding along floodplains; and surface faulting and land subsidence. A more in-depth discussion on natural processes is presented in Section III.A.2.

Alaskan Anadromous Habitat Loss. The freshwater spawning and rearing grounds and riverine migration routes used by anadromous salmonids, such as Pacific salmon and steelhead trout, are especially critical portions of their habitat since the productivity of individual stocks is directly related to the amount and quality of this habitat. In southeastern Alaska, the Tongass National Forest supplies timber for pulp mills at Ketchikan and Sitka and lesser volumes for smaller saw mills at several other locales. Some wood also is used for fuel and local construction. Logging can affect salmon streams and nearshore marine habitat through: a) siltation that reduces gravel permeability in streams with consequent loss of salmon eggs and pre-emergent fry. This sometimes results from illegally operating logging equipment in streambeds or across streams; b) stream blockage as a result of buffer strip blow downs following cutting; and c) water warming from loss of shade after cutting, with possible adverse effect on adult spawners and rearing fry. Over 200 watersheds in the southeastern Alaska Tongass National Forest have been affected to some degree.

The North Slope Borough (NSB) Capital Improvements Program (CIP). One of the goals in the formation of the NSB was the improvement of living conditions in North Slope Inupiat villages. With revenues from the Prudhoe Bay field, a network of NSB and construction subcontractor management, and maximum participation of Inupiat men and women in each project, this massive CIP has been used to construct schools and housing in every village, acquire gravel and land, improve airport runways, improve power generation and water and sewer systems, acquire maintenance equipment and search-and-rescue helicopters, and initiate areawide communications and solid-waste-disposal improvements for every village of the North Slope during the 1970's and early 1980's. Many of the projects have been completed. The focus of future expenditures emphasizes health and human services, safety, and the maintenance of facilities already built.

Pacific Anadromous Habitat Loss. The Pacific Fishery Management Council (PFMC) (1981) reviewed historical problems with, and the status of, freshwater habitat for anadromous salmon stocks in California, Oregon and Washington. In particular, the PFMC cited the many serious problems associated with hydroelectric dam construction and operation.

For example, construction of hydroelectric projects has flooded or blocked access to productive spawning habitat, while the operation of these facilities has resulted in reduced flows during migration and in spawning areas, increased turbidity and sedimentation of gravel, and temperature modifications. Such changes have completely eliminated many areas from salmon production, and have seriously reduced salmon production potential in other areas.

The PFMC review also cited poor land and water use practices such as logging, road building, water diversions, streambed alterations and pollution as factors responsible for substantially reducing or degrading the critical freshwater habitat. Based on the freshwater habitat review presented by the PFMC (1981:see Table A-1), substantial historical reductions in critical spawning and rearing habitat have occurred for many salmonid stocks in the California central valley (i.e., the Sacramento and San Joaquin system) and the Columbia River drainage systems. Based on the trend existing at the time of their review (1978), the PFMC (1981) estimated that habitat availability in all major river systems and coastal streams within California, Oregon and Washington would continue to decrease, or at best remain unchanged, over the next 10-20 years. Even with habitat rehabilitation efforts, the PFMC (1981) estimated relatively little improvement in habitat availability would be likely to occur over the next 10-20 years.

Although there are no current estimates of habitat availability, many of the same activities (i.e., hydroelectric plant operation and water diversions) that have resulted in habitat loss or degradation still continue. Efforts to mitigate or rehabilitate degraded freshwater habitat are in progress or planned in some areas (e.g., the Upper Sacramento River), and there is increasing recognition that substantial action is required to arrest the long-term trend of habitat loss and degradation, and reduced salmon production.

Coastal Development in California. At the turn of the century it was estimated that California had 381,000 acres of prime coastal wetlands. Within 75 years about two-thirds of this acreage had been lost to a variety of developments along the coast. These disturbances have ranged from large-scale, whole-ecosystem elimination to small-scale, habitat-specific alteration. They include, for example, urban development, harbor construction, dredging, dike and levee development, and marina development (Speth 1979; Zedler 1982). For a detailed description of habitat loss in California, see Section III.C.2.

Atlantic Region Habitat Loss. Human and natural activities have resulted in substantial alteration or loss of wetlands and other coastal habitat within the Atlantic Region. Causes of habitat loss are primarily due to extensive coastal development for commercial, residential, and recreational purposes. Habitat loss has affected the abundance and local distribution of various forms of wildlife and fisheries populations. Section III.D.2 contains information on wetlands, shorelines and other coastal habitats of the Atlantic Region.

MUNICIPAL WASTES AND OTHER ONSHORE EFFLUENT: Historically, the Nation's rivers, estuaries, and coastal waters have received municipal waste discharges since collection and treatment of domestic wastes were initiated. Prior to the 1970's, ocean disposal was largely unregulated, and adverse impacts on human health and the environment were observed.

The major point source discharge of waste materials into nearshore and coastal areas comes from sewage treatment facilities, industrial facilities, and electric generating facilities. These discharges are regulated by the USEPA. The effluent from the industrial and sewage treatment facilities may contain, even after treatment, substantial quantities of synthetic organics, heavy metals, suspended solids, oxygen-consuming materials, and nutrients. Sewage effluent may also contain fecal coliform and potentially pathogenic microorganisms. Powerplants' cooling waste discharges may be elevated in temperature and have increased chlorine levels.

Contaminants from marine transportation activities enter the sea intentionally as a result of routine operational discharges and unintentionally as a result of accidental spills. With respect to ships that maintain sizeable crews, the pollutants are the large amounts of domestic waste products such as sewage, food waste, plastic debris and trash from human activities on board. For recreational vessels, sewage disposal from marine sanitation devices in highly populated, confined harbors and anchorages is the primary pollution concern.

In contrast to the important progress made during the 1970's in controlling industrial point source discharges and in upgrading municipal sewage treatment facilities, progress with nonpoint sources is negligible. Nonpoint source pollution is primarily the result of precipitation falling and moving over and through land and into surface waters. In some cases, nonpoint source pollution is the result of human practices such as agriculture and irrigation. All land-use activities are potential non-point sources of pollution. Such sources are classified as urban and nonurban runoff. Pollution discharges from nonpoint sources greatly exceed the discharge from point sources. Chapter III includes a detailed discussion for each Region.

NONENERGY MINERALS:

Gulf of Mexico Sulphur Industry. The sulphur industry has been well established along the Louisiana and Texas Gulf Coast since the 1920's. The Frasch-mining process was developed to mine sulphur from the cap rock of salt domes in the area.

Three offshore mines, operated by Freeport McMoran, are in existence off Jefferson Parish, Louisiana. In support of the offshore mines, Freeport McMoran operates a shore support base located on the eastern end of Grand Isle, Louisiana. Production from the Grand Isle Mine is transported by pipeline to the Grand Isle facility where it is transferred to insulated barges for transportation to the shipping and processing terminal at Port Sulphur, Louisiana. Much of Freeport's sulphur is shipped up the Mississippi River to processing facilities in Louisiana or to Tampa, Florida, for use in the fertilizer industry.

At the present time, there is one producing sulphur lease in Federal waters in the Gulf of Mexico. This is in the Caminada Mine located in Grand Isle, Blocks 16, 17, 22, and 23, and operated by Freeport-McMoran. Hot water injection began on October 7, 1988, and sulphur production began on October 24, 1988.

Alaska Red Dog Mine. The Red Dog Mine is located 87 km from the Chukchi seacoast and 145 km north of Kotzebue. The seaport for the mine is located approximately 27 km southeast of Kivalina. Full production at a rate of 1.9 million metric tons of ore per year is expected to begin in 1993 and continue into the future. Variations in production after 1992 will reflect different percentages of lead, zinc, and other mineral concentrates in the ore that is mined. At full production, 5.5 thousand metric tons of ore per day, would be mined.

The port facility consists of a dock and causeway 40 m wide and 60 m long that extends into a water depth of 4 m. The dock will be about 210 m long and extend to a water depth of 5.5 m. Ore shipping will occur only during open-water periods (approximately 90 to 100 days/year). Ore will be loaded onto lightering vessels which will make four trips per day to ore carriers which will be loaded offshore. Ore carriers will make about 15 trips per year to smelters on the Pacific Coast of North America, the Far East, and Europe. The life of the field is estimated at 50 years.

Alaska Coal Development. Along the Chukchi seacoast from Cape Lisburne to Wainwright, especially near Cape Beaufort, coal (and its development) also is a potential source for cumulative effects on the Arctic subregion. The coal deposit of the Deadfall Syncline, located 10 km from the Chukchi Sea and about 64 km south of Point Lay, was identified as the best source for this use. A detailed feasibility assessment was completed in 1986. Development of this resource has been recommended and awaits further funding (Arctic Slope Consulting Engineers, 1986).

Alaska Offshore Mining Program. Two offshore areas along the northern shore of Norton Sound have valid mining leases—the area adjacent to the city of Nome and a small area off the coast near Bluff, about 85 km east of Nome. Twenty-nine prospecting permits have been issued in 1989 along much of the coast within 50 km to the east and west of Nome.

Alaska Onshore Mining. Mining potential on the Seward Peninsula is related primarily to gold, tin, lead, zinc, fluorite, beryllium, and tungsten. Of the non-gold prospects, the Lost River Mine is of greatest potential. Permits originally were received to mine and process 1,750,000 tons of ore/year (fluorite, tin, and tungsten) for at least 16 years, with possible expansion to 2,800,000 tons. At the lower production rate and using arctic-class bulk-ore carriers, approximately 50 round trips between the mine and market per year would be required for the low-end production and 80 trips for the high end.

Gold mining on the Seward Peninsula consists of more than 3,000 existing placer claims. However, most are small operations. In recent years, two other major operators have worked land near Nome owned by Alaska Gold Company—Windfall Mining Company and Anvil Mining Company. Both firms employed about 35 persons and worked from early April through early November. Ore from operations on Third Beach, an ancient beach line lying to the north of the city, is processed using a closed-water system (Saunders, pers. comm., 1988).

Several companies are exploring for lode gold; although none are in production at this time. Approximately 84 tons of gold were mined from the Big Hurrah gold mine during three previous operations. The mine is 64 km east of Nome on a tributary about 15 km up the Solomon River. Over a 5-year life, the mine is expected to produce at least 250 tons/day with an 8:1 stripping ratio. The mine is being designed as an open-pit mine.

In the Rock Creek area, about 13 km north of Nome, Placer Dome U.S., Inc., and Aspen Exploration are conducting a joint venture to explore for the original ore deposit which has been the source of the placer gold that has been mined over the decades. If sufficient concentration and field size are defined, a large processing plant would be required. Planning for such a facility depends upon the results of the exploration; development and production likely would take from 5 to 10 years to bring on line (Carpenter, pers. comm., 1988).

Coastal Oregon Placer Mining. The mineral resources located on the continental shelf of southern Oregon are presently being evaluated for their potential economic and strategic importance. Heavy minerals found in these offshore deposits include chromite, ilmenite, zircon, magnetite, garnet, and gold (Kulm, 1988). Although information on onshore mineral deposits indicates the potential for offshore deposits, until more is known about the location, extent, and characteristics of these deposits, the future of ocean mining off Oregon remains speculative.

The majority of the placer deposits off Oregon are located within State waters, and Oregon is currently developing administrative rules for offshore exploration and development of hard minerals. Development leases will not be issued by the State of Oregon until leasing rules have been finalized. To date, no State or Federal exploration permits have been issued for areas off Oregon.

STATE OIL AND GAS DEVELOPMENT:

Gulf of Mexico Region. Comprehensive information on oil and gas activities in State offshore and coastal waters in the Gulf of Mexico Region has not been compiled. Many activities carried out in State waters prior to the 1950's were neither documented nor permitted in the way they are now, and information is scarce or lacking (Groat, pers. comm., 1984).

In Texas State offshore waters, accumulated oil and gas production through October 1989 was 22.2 MMbbl of oil and 2,888 Bcf of wet gas (gas that includes condensate). Annual oil production peaked in 1977 at 2.6 MMbbl; whereas, annual gas production peaked in 1980 at 254 Bcf. Of the some 280 rigs operating within the State, 15 were located in offshore waters and none were located in inland waters (Baker-Hughes, November 1991). In addition, no inland drilling barges were operating in Texas coastal waters at that time. Approximately 1.95 MMbbl/day of crude oil and lease condensate are produced within the State.

In Louisiana State offshore waters, accumulated oil and gas production to January 1, 1988, was 1.442 Bbbl and 10,657 Bcf, respectively. Annual oil production peaked at 72.1 MMbbl, whereas annual gas production reached a peak of 604 Bcf in 1972 and thereafter steadily declined. The Louisiana Mineral Board conducts lease sales monthly. Of the some 90 rigs operating within the State, 43 were located in offshore waters and 13 were located in State inland waters (Baker-Hughes, November 1991). In addition, 29 inland drilling barges were operating in Louisiana coastal waters at that time. Approximately 1 million barrels per day of crude oil and lease condensate are produced within the State (Oil and Gas Journal, October 1991).

The State of Mississippi has experienced a limited amount of offshore activity. Three exploratory wells were drilled in the 1950's; all were dry holes, and the relevant leases have expired. In late August 1986, an exploratory oil and gas well was drilled in Mississippi coastal waters 7 km (4.5 mi) south of Ship Island. Fifteen days after drilling had begun, the drilling was terminated. Currently, 14 land-based rigs are operating in the State, with no active leases in Mississippi State waters. Thirteen rigs are operating within State onshore areas (Baker-Hughes, 1990). Approximately 73,000 bbl/day of crude oil and lease condensate are produced within the State.

Oil and gas activity in the State of Alabama's offshore waters has increased over the past few years. The Lower Mobile Bay Mary Ann Field was discovered in 1979. Since that initial discovery, several others have been made, confirming the commercial potential of natural gas in Mobile Bay. There are two producing fields in Alabama State waters—the Lower Mobile Bay May Ann Field and the South East Mobile Bay Field. Of approximately eight rigs operating within the State, three are located in offshore and inland waters (Baker-Hughes, 1990). Approximately 49,000 bbl/day of crude oil and lease condensate are produced within the State.

The State of Florida has experienced a limited amount of drilling in State coastal waters. Between 1945 and 1983, 29 exploratory wells were drilled in waters under Florida jurisdiction at sites extending along the entire Gulf Coast from Pensacola to the Keys and Dry Tortugas. None of these wells resulted in development or production. Coastal Petroleum Company holds the only two active leases in Florida waters as of January 1989. These leases, which date back to the 1940's, are large in size and geographic coverage. Currently, there is a moratorium on drilling activity in Florida State waters, and the State has no plans for lease sales in the future. One rig is now operating within State onshore areas (Baker-Hughes, 1991). Approximately 10,000 bbl\day of crude oil and lease condensate are produced within the State .

Alaska Region. Since 1959, the State of Alaska has conducted 57 lease sales. Of these lease sales 37 have offered some offshore acreage, while 7 of these were entirely offshore. Currently, there are 1.6 million offshore acres under lease. The producing offshore leases are located in Cook Inlet and the Beaufort Sea. Oil produced from the Beaufort Sea is transported via pipeline to the TAPS.

After a hiatus in exploration activities in State waters and coastal areas from January 1987 to August 1988, when most operators in Alaska focused their attention on development projects, several exploration projects commenced. These projects were concentrated on the North Slope and in the State waters of the Beaufort Sea. The exploration activities for Point McIntyre Prospect, Karluk Prospect, Stinson Prospect, Badami Prospect and Point Thompson Unit are described in Gould et al. (1990).

After 12 years of producing oil, the Prudhoe Bay Unit field started to decline in average daily production in 1989. It is approximately 59 percent depleted. The average daily production in 1988 was 1.6 MMbbl/day, but estimated production in the fall of 1989 indicated that the average daily production would be about 1.4 MMbbl/day and by 1994 it would fall below 1 MMbbl/day.

The Endicott field is the only offshore producing field in the U.S. Arctic waters. This project consists of a main production island, a satellite drilling island, and gravel causeways connecting the islands to each other and to shore. Full production began from Endicott in October 1987, and has averaged about 100,000 bpd. Other fields being developed or considered for development include the West Sak Field, Lisburne field, and the Milne Point field (see Gould et al., 1990).

Preliminary analysis of the well drilled in the Point McIntyre Prospect estimates reserves around 300 MM bbl of oil. Although it will be several years before this oil is produced, it will represent a major boost in production as other fields continue or start to decline. Similarly, the proposed Northstar-Seal Island unit, if approved and developed, could also help to offset production declines in currently producing fields.

Pacific Region. Existing facilities in State waters include 8 platforms, 6 artificial islands and 39 subsea completions. The Shell Hercules project which proposed the installation of one platform and subsea pipelines to shore to existing processing facilities was canceled by Shell in April 1989. Arco Coal Oil Point Project which proposed the installation of three platforms and subsea pipelines to shore, onshore oil and gas processing facilities, and onshore pipelines from landfall to treatment facilities was denied by the State Lands Commission. The decision by the State Lands Commission is currently being litigated. Union Cojo Project which proposed the installation of one platform and subsea pipelines to shore, onshore pipelines from landfall to Union's Lompoc oil dehydration facilities was submitted to State and local agencies and is still under review. In March 1988, Texaco began removing its platforms Helen and Herman 30 years after they were set on leases in the Santa Barbara Channel. The pipelines were removed July 27, 1988.

At the refineries, crude oil undergoes several processing stages, including separation, conversion, and treatment. Refineries range in size from small plants capable of processing only 190 bbl/day of crude to complex facilities that process more than 500,000 bbl/day. For a list of refineries and their capacities for the Pacific Region, see Table 18 in the Pacific Update: August 1987 - November 1989 (Slitor et al., 1990).

Several fabrication and assembly facilities located in California and Washington have been employed for producing decks and jackets for OCS development, but none of the existing yards currently have any related contracts on order. The jackets for Platforms Eureka, Henry, Hillhouse, Hondo, and Unocal's Platforms A, B, and C were built in Pacific coast fabrication yards.

In recent years, many of the construction contracts for platforms planned for offshore California have been awarded to Japanese, Korean, or Malaysian contractors because of their cost competitiveness. Currently, less than half of the jackets installed on the Pacific OCS have been produced domestically.

Recently, more of the topside construction work for platforms offshore California has been awarded to Pacific coast yards. Most recently, platform modules for Platform Gail were fabricated by Kaiser Steel at a yard in Stockton, California. Previous deck and module construction was performed by Pacific coast yards in Port Hueneme, Oakland, Napa, San Bernardino, and Vallejo, California, and in Anacortes and Vancouver, Washington (Gould et al., 1991).

Most marine terminals in the Pacific Region are located in southern California. They include: Estero Bay, Morro Bay, Port San Luis, Gaviota, Hondo OS&T, El Capitan, Ellwood, Carpinteria, Ventura River, Ventura, El Segundo, Los Angeles/Long Beach and Huntington Beach. There are also five marine terminals in the San Francisco Bay area: San Francisco, Oakland, Benicia, Richmond, and Redwood City. There are four marine terminals in Washington: two at Cherry Point and two at March Point near Anacortes. These marine terminals handle crude oil from the North Slope of Alaska and should be sufficient to handle all production from this proposal.

All American Pipeline/Celeron Pipeline. The project is a 1,750-mile pipeline system to transport OCS and other locally produced crude oil from Santa Barbara Channel/Santa Maria Basin to Webster, Texas. Installation of the coastal segment between Gaviota and Las Flores Canyon is complete. Construction at many of the pump stations is complete. The company is projecting to begin pumping crude oil in the first quarter of 1991. On April 9, 1991, Santa Barbara County Resource Management Department issued approval of compliance with all "prior to start-up" Final Development Conditions. The pipeline system is physically complete and ready to receive oil.

Southern California Pipeline System (SCPS). The SCPS project proposes to transport crude oil from Santa Barbara County to Emidio in the San Joaquin Valley and to refineries in the Los Angeles Basin. This project is planned by a consortium of four operators: Four Corners Pipeline Company, a subsidiary of Atlantic Richfield Company; Chevron Pipeline Company; Texaco USA, and Shell Oil Company. The 30-inch diameter line is expected to transport 200,000 bbl/day and would allow for the addition of about 130,000 bbl/day entering from the San Joaquin Valley. The status of the pipeline is indefinitely suspended.

Pacific Pipeline System, Inc. On October 10, Pacific Pipeline System, Inc. filed an application with the California Public Utilities Commission to build a 170-mile, 20-inch diameter, unheated pipeline along existing railroad rights-of-ways from Gaviota in Santa Barbara County to refineries in Los Angeles . The proposed pipeline would be capable of transporting up to 130,000 barrels of crude oil per day. The pipeline is to be completed in the spring of 1994 and is intended to provide for transportation of Santa Barbara Channel OCS crude oil to refineries in Los Angeles.

CANADIAN OIL AND GAS DEVELOPMENT: Drilling began in Canada in the 1960's. To date, over 237 wells had been drilled in the Canadian Arctic, both offshore and onshore. Most oil shows, however, have been offshore. Among the promising fields is Amauligak with resource estimates of 700 to 800 MMbbl. Other finds in the area include: Tuk J-29, Pitsiulak, and Nipterk. Wells have been drilled from gravel islands, caisson-retained islands (Tarsuit), bottom-founded mobil units (Semi-Submersible Drilling Caisson and Mobil Arctic Caisson), and floating units (drillships and a conical drilling unit). Tuktoyaktuk and McKinley Bay are the primary service bases; additional facilities are on Hershel Island and have been proposed for King Point in the Yukon Territory. McKinley Bay's ship-repair facilities are adequate to service the entire range of vessels present in the Arctic (Evans, pers. comm., 1985). In spite of these promising resource estimates, no production or oil-field development has taken place. However, application has been made by the Canadian

Beaufort operators to transport natural gas down a gas pipeline constructed through the Mackenzie River Valley from Norman Wells to the Tuk Peninsula.

For the transportation system, options that have been considered for full production include a tanker route through the Northwest Passage (an overland pipeline through the Mackenzie Valley), or a combined tanker-pipeline route. Plans to tanker Canadian crude to Asia through the U.S. Beaufort and Chukchi Seas were considered by Canadian operators but will not be utilized.

DOMESTIC TRANSPORTATION OF GAS AND OIL:

Deepwater Ports. The Deepwater Port Act of 1974 (33 U.S.C. §1501) gives the USDOT the authority to license deep-water ports. The purpose of a deep-water port is to provide offshore terminal facilities for the offloading of oil from tankers too large (typically supertankers with drafts greater than 40 ft and up to 700,000 dwt) for conventional ports and to transport the oil to shore via pipeline, thus avoiding the need for lightering. The Louisiana Offshore Oil Port (LOOP) is the only deep-water port in the Gulf. It is located in 115 ft of water in Grand Isle Block 59, approximately 19 miles from shore. Vessel access to the LOOP is by means of the designated fairway and safety zone. No mobile drilling operations or installation of permanent structures may take place in these areas. An anchorage area is also designated in the vicinity of the LOOP. Fixed and mobile structures may be placed in anchorages under certain spacing limitations. In 1988, the LOOP offloaded 770,000 bbl/day of crude oil per day from tankers,of which 12.8 percent was domestic crude.

Gulf of Mexico Marine Transportation. Vessels operating offshore often utilize the network of established safety fairways. Over the years, an extensive shipping pattern developed among the major ports and between the ports and final destinations.

Marine transportation traffic can contribute to operational errors, which might result in groundings or in collisions involving other vessels or fixed structures such as platforms and rigs. This may lead to losses in lives and property, and possibly environmental damage if hazardous cargo is involved.

The key mitigation factor for this problem was the establishment of a series of safety fairways and anchorages to provide an unobstructed approach for vessels using U.S. ports. Fairways play an important role in the avoidance of collisions on the OCS, particularly in the case of the larger ocean-going vessels, but not all vessels stay within the fairways. Many vessels, such as fishing boats and vessels supporting offshore gas and oil operations, travel through areas with high concentrations of fixed structures. In such cases the most important mitigation factor is the requirement for adequate marking and lighting of structures. After a structure has been in place for a while, it often becomes a landmark and an aid to navigation for vessels that operate in the area on a regular basis. A complete discussion of vessel traffic patterns is contained in Chapter III for each Region.

Gulf of Mexico Waterborne Commerce. There is a substantial amount of domestic waterborne commerce along the Gulf Coast that does not always utilize open Gulf waters. Vessels engaged in this activity generally use the Gulf Intracoastal Waterway, which follows the coastline inshore and through bays and estuaries and, in some cases, offshore from Fort Myers, Florida, to Brownsville, Texas.

Trans-Alaska Pipeline System (TAPS). The majority of the oil produced in Alaska is transported via TAPS. The TAPS began transporting crude oil from the Alaska North Slope to Valdez on June 10, 1977. The Trans-Alaska Pipeline (TAP) is a 48-inch diameter pipeline designed to have a potential capacity of 2.0 MMbbl/day, although 1.7 MMbbl/day has been set as the maximum efficient rate by the Alaska Oil and Gas Conservation Commission. The majority of the crude oil is transported from the Valdez terminal facility to west coast ports (Puget Sound, Washington; and San Francisco and Los Angeles, California) and the Gulf of Mexico ports.

The terminal at Valdez is able to handle four tankers at one time and has an average turnaround time of 24 hours. The TAP is presently delivering crude oil from Prudhoe Bay. The bulk of Alaskan oil production over the next decade is expected to continue from currently known fields: Prudhoe

Bay, Kuparuk, Endicott, Lisburne, West Sak, and Milne Point Energy Information Administration (USDOE, Energy Information Administration (EIA), 1990), and from the possible development of new prospects: Point McIntyre, Kaktovik, Niakuk, Northstar, and Point Thomson Unit. Table 9 in the Alaska Update: September 1988 - January 1990 (Gould, et al. 1990) provides estimates of in place and recoverable reserves for these field and other units/fields or prospects in the North Slope Area. Although these field will temporarily offset current production declines, the USDOE, EIA (1990) projected that the production profile for North Alaska (reference case) will decline from 1.84 MMbbl/day in 1990 to 0.28 MMbbl/day in 2030. It is, therefore assumed that over the life of the proposed action the number of shipments and the amount of oil from the Valdez terminal will decrease steadily.

More than 7.8 billion barrels of oil have been handled at the Valdez terminal facility. Since that time 10 tanker spills greater than 1,000 bbl have occurred. Using a TAPS tanker spill rate (1.28 spills per billion barrels transported) and data on estimates of recoverable oil resources and reserves in USDOE, EIA, 1990; and Gould et al., 1990, it is assumed that over the life of the proposed program approximately 10 billion barrels of North Slope crude oil (non-OCS) would be transported by the TAPS. It is assumed that 13 tanker spills greater than or equal to 1,000 bbl would occur in association with the transportation of the oil. It is assumed that 6 spills will occur in the Alaska Region, 5 spills in the Pacific Region and 2 spills in the Gulf of Mexico Region.

Trans-Alaska Gas System (TAGS). This proposed system would transport natural gas from Alaska's North Slope via a 36-inch outside diameter pipeline to a tidewater facility at Anderson Bay, Port Valdez, Alaska. The proposed TAGS route closely parallels the existing TAPS oil pipeline. Up to 2.3 billion cubic feet of conditioned natural gas per day would be moved through TAGS. At Valdez, the natural gas would be converted to liquefied natural gas for export by tanker to markets in the Asian Pacific Rim.

Cook Inlet Oil. An increase in Cook Inlet-produced oil may be shipped to markets in the Far East if allowed by Congress. Laws currently restrict the export of oil produced from Federal and State leases in Cook Inlet to 3,000 bbl/day (about two tankers per year), the current level of export. However, efforts are under way by Alaska's congressional delegation to end these restrictions. If the restrictions are removed, it is estimated that 36 MMbbl of oil may be transported by tankers over the life of the Cook Inlet Field. This could amount to an average of about 14 tanker trips per year. It is believed that the tankers would travel the great circle route from Cook Inlet to Pacific Rim markets, which would result in tankers traveling through Unimak Pass and then westward just north of the Aleutian Islands. Alaska OCS Planning Areas likely to be affected would include Gulf of Alaska/Cook Inlet, Kodiak, Shumagin, and St. George Basin.

OTHER PROJECTS AND PROPOSALS

Arctic National Wildlife Refuge (ANWR). The ANWR is situated in the northeastern part of Alaska. The boundaries of the coastal plain portion of the ANWR facing the Beaufort Sea extend from the Canning River Delta on the west to the Canadian border on the east.

Controversy as to whether or not the coastal plain of ANWR should be open for natural gas and oil exploration and development led Congress to create Section 1002 of the Alaska National Interest Lands Conservation Act (ANILCA). This section laid out guidelines for the Secretary of the Interior to follow prior to reporting to Congress recommendations for the use of the coastal plain, or 1002 area. The FWS released its final legislative Environmental Impact Statement (FLEIS) on the potential effects of exploration and development on the coastal plain in April 1987 (USDOI, FWS, 1987). The FLEIS analysis was based on a 250-km pipeline that would extend from the easternmost development hypothesized in the ANWR to TAPS Pumping Station No. 1.

The conditional, economically recoverable resource in the mean case for the FLEIS was estimated at 3.57 billion bbl with a 46-percent probability of oil being present. Approximately 5,120 hectares, or 0.8 percent of the 1002 area, would be modified from its initial condition. Approximately 320 to

500 km of all-season gravel roads within several oil fields and about 180 km of road between the Canning River and the marine facilities at Pokok Lagoon were assumed in the FLEIS.

The Secretary of the Interior recommended to Congress that the entire Arctic Refuge coastal plain be made available for gas and oil leasing. Section 1003 of the ANILCA states that production of gas and oil from the ANWR is prohibited, and no leasing or other development leading to production of gas and oil from the range shall be undertaken until authorized by an act of Congress. It is uncertain whether Congress will enact legislation authorizing leasing of ANWR lands in the foreseeable future. However, based on projection in the National Energy Strategy, it is assumed that ANWR production would occur sometime during the life of the proposal.

Ports of Los Angeles/Long Beach 2020 Master Plan. The 2020 Master Plan (Vickerman Zachery Miller, Inc. and CH2M Hill, 1988) constitutes a major action proposed to meet future cargo-handling demands projected for the Ports of Los Angeles and Long Beach (San Pedro Bay Ports) through the year 2020. This proposed action would provide additional land for new terminal development and create several deep-water channels to meet the ever growing need for increased cargo throughput.

Presently, there are about 70 terminals in operation at the San Pedro Bay Ports; in 1985 these terminals were responsible for handling about 75 million metric tons of cargo. By the year 2020, the demand for cargo throughput is expected to reach almost 200 million metric tons. In order to preclude the necessity for developing new ports elsewhere in the State, the Ports of Los Angeles and Long Beach are developing plans for modernizing and expanding. These plans call for optimizing the use of the existing facilities and constructing new facilities and deep-water channels to meet the demands of foreign and domestic waterborne commerce and other traditional water-dependent and water-related activities.

Based on the projected cargo tonnage for the year 2020, 38 to 39 new terminals are needed to accommodate the increase, requiring the creation of 2,400 to 2,800 acres (972 to 1,134 ha) of additional land from 225 million cubic yards (172 million cubic meters) of dredging resulting from the development of deep-water channels 50 to 85 ft (15 to 25 m) deep.

Southern Sea Otter Translocation Program. The goal of the sea otter translocation program has been to establish a second breeding colony to help insure the continued survival of the species in the event of any single natural or man-caused catastrophe (USDOI, FWS, 1987b). The designated site for the second colony is San Nicolas Island, located 145 km (90 mi) southwest of Los Angeles. In order to achieve this goal the FWS was to translocate up to 70 otters per year to the island, with the total number of translocated otters not to exceed 250. As part of the translocation program, the Southern California Bight outside the area around San Nicolas Island is to be maintained as an otter-free zone by use of nonlethal capture techniques. The translocation of otters from the central California coast began in August 1987. As of June 1991, 252 otters had been caught along the central California coast. Of these, 151 were judged to be healthy and of the right age and sex for translocation. Eight otters died and four were returned to the original capture site. The remaining 139 otters were translocated (USDOI, FWS, 1990a; 1991a, b); of these, only 14 are known to have remained within the translocation area, 31 have returned to the central coast, 3 returned to the mainland in the otter-free zone and were captured, 10 are known to have died, and the fate of the remaining 81 is presently unknown. Thirteen sea otters have been born on San Nicolas since the translocation effort began in August 1987, with 11 of these births occurring since July 1989.

No sea otters were translocated to San Nicolas Island during the fourth year of the program due to time spent waiting for resolution of state and federal permits, coordination efforts with the California Coastal Commission, and conflict for tank space with sea otters being rehabilitated at the Monterey Bay Aquarium (USDOI, FWS, 1990a; 1991a, b). Although no sea otters are currently being translocated and otters are present in the management or no-otter zone, the USFWS has concluded that the translocation does not yet meet the criteria for determination of failure and termination of the project (USDOI, FWS, 1990a; 1991a, b).

FOREIGN CRUDE OIL IMPORTS: Most foreign crude oil arrives in the United States by tanker. Major ports receiving foreign crude oil are located on the east coast in the Mid-Atlantic, in the Gulf of Mexico around Houston and Beaumont/Port Arthur in Texas, and New Orleans/Lake Charles in Louisiana; and on the west coast around Los Angeles and San Francisco in California and along Puget Sound, Washington. Another major entry point of foreign crude oil is the LOOP.

Mexico was the major source of U.S. petroleum net imports in 1982 through 1985. By 1989, Saudi Arabia, Canada, Venezuela, and Nigeria each supplied more petroleum to the United States than did Mexico. Daily net imports rose to 7.1 MMbbl in 1989 (USDOE, EIA, 1990b).

With U.S. oil production continuing to decline and demand rising slowly, net oil imports are projected to rise to about 14.8 MMbbl/day in 2010 and 20 MMbbl/day by 2030 (National Energy Strategy - Current Policy Base Projections). Based on these projections, the National Energy Strategy forecasts that 7 out of every 10 bbl in 2010 and 8 out of every 10 bbl in 2030 used by this country would be imported crude. With the combined reductions in oil consumption coupled with the higher production levels proposed by the National Energy Strategy, net oil imports would decrease. Imports under this scenario are projected to reach 8.3 MMbbl/day in 2000, about 7.8 MMbbl/day in 2010 and less than 11.6 MMbbl/day by 2030. This would result in a 40-percent reduction in U.S. dependency on imported oil relative to the current base.

ICF Resources (1991) developed marine transportation estimates based on the July 1990 draft Nation Energy Strategy petroleum market projections for the 1990 - 2030 period. Based on the market projections, ICF Resources estimated that approximately 123.6 billion barrels of foreign crude oil would be imported into the United States by the year 2030. This represents over 200,000 tanker trips by a 100,000 dwt tanker. Based on these estimates, it was assumed that 81 tanker spill of 1,000 bbl or greater would occur in U.S. waters during this period. Using ICF Resources market projections, it was assumed that 63 spills would occur in the Gulf of Mexico Region, 5 spills in the Pacific Region, and 13 in the Atlantic Region.

NASA AND DEPARTMENT OF DEFENSE ACTIVITIES:

Military warning areas are established through the Federal Aviation Administration (FAA) Handbook 7400.2B, Part 5, Chapter 15. This Handbook sets aside an air space area by the FAA for military use. The military is not given a first use or a priority use of any area. The areas of military use are set aside for FAA to direct air traffic over or around. The FAA Handbook also refers to an Executive Order that calls for coordination among the Departments of Transportation, State, and Defense (USDOD) on the establishment and use of warning areas in international waters (international waters are considered by the FAA as anything beyond the State/Federal boundaries). By the mechanisms through which the military warning areas are established and maintained, USDOD or any other agency cannot restrict the use of a warning area. Also, the mechanisms for the establishment of a warning area do not provide any means of enforcement of a warning area.

Gulf of Mexico Region. The air space over the Gulf of Mexico is used extensively by USDOD for conducting various air-to-air and air-to-surface mission operations. A series of nine military warning areas and five water test areas are located within the Gulf. These warning and water test areas are multiple-use areas, wherein military operations and gas and oil development have coexisted without conflict for many years.

The central Gulf has three warning areas that are used for military operations. They total approximately 4 million acres or 7.6 percent of the water and air space of the area. The two Eglin Water Test Areas comprise another 4 million acres or 7.3 percent of the central Gulf. The western Gulf has two warning areas used for USDOD operations. They total approximately 12 million acres or 33 percent of the water and air space of the area. The eastern Gulf of Mexico has five warning areas for various military operations. They total approximately 32 million acres or 55 percent of the water and air space of the area. The five water test areas of the eastern Gulf cover an additional

40 percent of the area. They have an official warning area status, and thus, there are restrictions on gas and oil development within these areas.

The USDOI has recognized a high-priority USDOD use area in the eastern Gulf within the water test areas and warning areas 155, 151, and 470. Also, the USDOD has expressed concern over the possibility of increased gas and oil activity in W-174.

Pacific Region. There are extensive flight operations conducted off the Pacific Northwest. Portions of the area which parallel the coast have been designated by the Navy for submarine transit lanes. Military activity along the northern California coast include all weather flight training, submarine movement, and anti-submarine warfare training.

Essentially all of the southern California OCS except for the Santa Barbara Channel are directly used for various military operations. The key military facilities include the Western Space and Missile Center at Vandenberg Air Force Base, the Pacific Missile Test Center at Point Mugu, San Nicolas Island, the Naval Shipboard Electronic Systems Evaluation Facility at Long Beach, the Marine Corps at Camp Pendleton, the San Clemente Island Training, Firing, and Buffer Zone, and Fleet Area Control and Surveillance Facility at San Diego.

Atlantic Region. There are several military warning areas in the North Atlantic Planning Area. The Boston Operating Area, located east of Massachusetts and Maine, covers much of the northern portion of this planning area. The controlling authority is the Commander, Submarine Squadron Two, Naval Submarine Base, Groton, Connecticut. The Narragansett Bay Operating Area (W-72, W-387, W-108, and W-386) includes the extreme western portion of the North Atlantic Planning Area. The controlling authority is Commanding Officer, Fleet Control and Surveillance Facility, Virginia Capes, Virginia Beach, Virginia. An Air Force warning area, designated W-506, lies within the central portion of this planning area. This is an aircraft training area managed by the 21st Air Division, Hancock Field, Syracuse, New York. The controlling authorities for each operating area are responsible for directing oceanic and air maneuvers in their respective jurisdictions and for coordinating them with other military or nonmilitary endeavors.

The National Aeronautics and Space Administration (NASA) and the USDOD both use portions of the Mid-Atlantic Planning Area. The area surrounding Norfolk, Virginia is homeport for a majority of the U.S. Atlantic Fleet air and surface units. These and other units use warning areas W-386, W-72A, and W-108. Warning and operational areas also include areas offshore Norfolk, Virginia (W-107), and an Atlantic City Operating Area (W-107) which extends north toward the Narragansett Bay Operating Area. The NASA operates a warning area offshore the Wallops Island Flight Facility which is kept free of surface activity during rocket launches.

In the South Atlantic Planning Area, military warning areas exist offshore Cherry Point, North Carolina; Charleston, South Carolina; and Jacksonville, Florida. Water and air spaces offshore Cherry Point, Charleston, and Jacksonville are used by USDOD for various purposes including training, readiness, and support of national security interests and defense.

The John F. Kennedy Space Center (KSC) at Cape Canaveral, Florida, is a NASA installation from which numerous satellites and other spacecraft are launched each year. It is the primary launch site of the space shuttle program. The military uses the Eastern Space and Missile Center (ESMC) which is also located at Cape Canaveral. The area offshore is also used for submarine missile launch activities. The flight clearance zone for the KSC and ESMC is the extent of the area which NASA and USDOD require to be kept free of surface activity during missile and space shuttle launches.

More than 60 percent of the nondeferred portion of the Straits of Florida Planning Area is used by the Air Force, Navy, and NASA for air, surface, and subsurface operations. Warning Areas 174 and 465 are used by the Navy for aircraft carrier operations, carrier pilot training, gunnery and bombing practice, and submarine maneuvers. The flight clearance zone does not extend into the nondeferred portion of the Straits of Florida Planning Area.

(1) Impacts on Water Quality

(a) Gulf of Mexico Region

COASTAL AND ESTUARINE WATERS: The cumulative analysis considers the effects of low-level routine point and nonpoint source discharges, such as industry effluents, natural seepage, and both chronic low-level and large accidental hydrocarbon and chemical discharges entering the coastal or nearshore waters of the northern Gulf of Mexico. These discharges occur from urban and agricultural expansion; municipal and industrial wastes; recreational and commercial boating; maritime commerce; dredging activities; natural events; State oil and gas development activities; and the proposed action plus other OCS oil and gas development activities due to past and future sales. Section IV.D.1.c presents information on major activities occurring in the Gulf and its coastal areas.

Natural phenomena which affect the Gulf's water quality include red tides, hypoxia, and natural oil seeps. Red tides are a natural phenomenon in the northeastern Gulf caused by blooms of single-celled algae. The red tide algae *Gymnodinium breve* produces toxins that are released to the water when the cell membrane is ruptured. The release of toxins in high concentrations causes fish kills, contaminates shellfish areas, and can cause respiratory problems with humans. These blooms move into the coastal areas from offshore by winds, currents, and tides. In the northeastern Gulf, redtides move southward after reaching nearshore waters, and in some cases are transported around the Florida peninsula and then northward by the Gulf Stream. Hypoxic or oxygen depleted bottom waters contain levels of dissolved oxygen so low that biological productivity is impeded. This phenomenon occurs mainly during the months of June-August and is associated with strong thermohaline stratification and a significant source of oxidizable organic material. This condition occurs along the inner continental shelf from the Mississippi River Delta to southeast Texas. Similar conditions are found in the bays and estuaries (Galveston Bay in Texas, and Lake Pontchartrain and Calcasieu Lake in Louisiana) of this region. From 1985-1987, over 8,000 km^2 of inner shelf bottom waters off the Louisiana coast were found to be hypoxic. The nutrients carried into the Gulf of Mexico by the Mississippi River have contributed to the Gulf's enormous fishery productivity. However, inorganic nutrients (nitrates) transported into the Gulf from runoff carried by the River has been cited as a major cause of hypoxia. Hypoxia can affect both the mortality and redistribution of finfish and shellfish populations. Lastly, natural oil seepage in the Gulf's coastal zone and marine environments has been documented for centuries. The composition of seep oil is similar to that of produced crude oil. The direct input of petroleum hydrocarbons from natural seeps into the marine environment has been estimated at 0.6 million metric tons per year (Wilson et al., 1973).

Continued offshore and onshore oil and gas activities will contribute to the cumulative impacts on coastal and nearshore water quality. An unknown number of additional structures and facilities may be constructed as a result of resource development in State waters and coastal areas. The construction and operation of onshore facilities supporting domestic and international oil and gas activities may impact coastal and nearshore water quality by routine point and nonpoint source pollution. Increased effluent discharges from support facilities may contribute to point source pollution within coastal areas. These effluents are commonly discharged into surface waters after treatment. Surface runoff from existing refining and processing facilities is extensive and can adversely impact the surrounding area. Runoff from these facilities is likely to contain oil, brine, particulate matter, heavy metals, petroleum products, process chemicals, and soluble inorganic and organic compounds leached from the soil surface. Aside from adding contaminants to coastal waters, runoff from such facilities may alter circulation in wetland areas, and affect flushing rates and salinity gradients. Because the majority of the facilities expected to support oil and gas refining and processing activities are located primarily in coastal Texas and Louisiana, impacts of chronic discharges from these sources are expected to be focused there.

Other causes of nonpoint source contamination are listed in an assessment by the State of Louisiana in the Section 319 State of Louisiana Nonpoint Source Pollution Assessment Report (Louisiana Dept. of Environmental Quality, 1988). The report identifies agriculture, general construction in the coastal zone, hydromodification, silviculture, septic tank leakage, and urban runoff (Louisiana Dept. of Environmental Quality, 1988). This report shows a substantial percentage of the coastal area significantly affected by nonpoint source pollution so that identified areas do not support fully designated uses of surrounding water. Given the expected continuous nature of these discharges, but accounting for the filtering and assimilative capacity of wetlands (Kennedy, 1984) and the improved environmental regulatory programs adopted by the Gulf coastal States (such as tougher water quality standards), chronic point and nonpoint source discharges are expected to cause localized and short-term (up to several weeks) degradation of coastal waters throughout the Gulf region.

Section IV.D.1.c presents an overview of the major sources of oil contamination in the Gulf. This overview shows that these larger oil spill incidents and chronic small inputs impact water quality but are overshadowed by the input of the Mississippi River. Clearly, the major source of oil contamination of Gulf waters is the contaminated waters coming down the Mississippi River (78%). This conclusion is supported by a number of major studies conducted in the Gulf of Mexico, including the MAFLA study, the Buccaneer Oil Field Study (Bedinger, 1981), and the Southwest Research Institute Platform Study (Middleditch, 1981). The Mississippi River also carries both nonpoint source runoff and point source discharges from industrial, municipal, and agricultural industries along or near its levees. The plume contains high amounts of sediments and organic chemicals, trace metals, and pesticides, which interact with the coastal and nearshore waters of Louisiana and Texas. Hydrocarbons were the most significant of the pollutants found in the sediments of Mississippi Sound (Delfino et al., 1984). Analyses revealed three principal sources of pollutant hydrocarbons: petroleum associated with the Pascagoula refinery, fuel oil, and sewage. Land runoff apparently contributed some of the contamination.

Vessel traffic associated with both State and international oil and gas industry activities is expected to be extensive in the Texas and Louisiana coastal areas, especially within the Mississippi Delta area. Discharges from service boats and barges, although diluted and discharged slowly over large lengths of channel, will be great enough to result in some degradation of water quality in the navigation channels traversed. Besides impacts to water quality from operational discharges of oil and gas industry vessel traffic, impacts will occur along the Gulf's coastal waterways, the GIWW and within bays and coastal rivers from discharges from other types of vessel traffic. These include maritime commerce, private recreational boats, and commercial and recreational fishing activities. The combined vessel traffic associated with these activities will be extensive and is expected to impact nearshore and coastal waters within the entire coastal zone through bilge and ballast water discharges, sanitary and domestic waste discharges, releases of antifouling paint compounds, and chronic small and large spill events. Impacts from such sources are substantial enough to cause low-level effects when discharged into confined waters over a long time period. Impacts to open waters are expected to be negligible, not causing changes in water quality characteristics.

The discharge of sewage and wastes from boats and vessels in coastal waters may impact water quality by increasing BOD locally and introducing pathogens into the water column. The Federal Water Pollution Control Act requires recreational boats to be equipped with approved marine sanitation devices; however, boats still discharge treated legally and untreated waste illegally into coastal waterbodies. Although the wastewater generated by recreational boats is small, the organics are concentrated and therefore the BOD levels are much higher than that of raw or treated municipal sewage. When this occurs in poorly flushed waters, the DO concentrations of the water may decrease. In the more temperate regions, these effects are exacerbated due to increased boat traffic, higher water temperatures, and higher metabolism rates for marine organisms. The addition of disease-carrying pathogens from fecal matter in boat sewage poses a potential problem with regards to human health impacts. Humans are put at risk from either contacting contaminated waters through swimming or eating shell fish taken from such waters. Bacteria, viruses, and other water-borne diseases can be attribute to sewage pollution.

Antifouling paints and coatings containing copper and organotin biocides are used to prevent the buildup of barnacles and other encrusting organisms on vessels and docks. Other toxic compounds such as mercury, arsenic, and PCB's are no longer used due to their extreme toxicity. By 1985, up to 30 percent of the vessels world-wide used tributyltin-containing antifouling paints. A 1987 survey found that 97 percent of the tributyltin use was on vessels or boats less than 65 feet and that 93 percent of this was on recreational boats. Tributyltins are a class of organic tins used in antifouling paints. There are two classes of these paints—conventional or those that leach continuously and copolymer which are released to the aquatic environment at much slower rates. Due to the rapid leaching of these compounds, elevated levels of tributyltin and its breakdown products have been found in the water, sediments and organisms where there are high concentrations of vessels and more specifically, recreational boats.

Studies indicate organotin is highly toxic to marine and freshwater organisms, at very low levels. Tributyltins have been reported to cause acute and chronic toxicity to marine organisms, especially in small crustaceans (zooplankton) and bivalves. Bacteria and phytoplankton bioaccumulate tributyltin at concentrations of 600 to 30,000 times the exposure concentration, while bioaccumulation in bivalves has been reported up to 4,000 times the exposure concentration. Bivalves are extremely susceptible because of their ability to metabolize these compounds and they are found in nearly anoxic sediments that lack the bacterial species necessary to degrade these compounds. Unlike copper, tributyltin in seawater degrades rapidly with a half-life of 3-15 days (seawater). Within the water column, the primary means of degradation in the presence of light appears to be debutylation by planktonic algae, especially diatoms. While in the absence of light, degradation is primarily by bacteria. Tributyltins tend to concentrate in the surface microlayer and are found at higher levels than found in the subsurface. Once these compounds adsorb to particulate matter and sinks into the sediments, it tends to concentrate and slowly degrade.

Tributyltin paints are now regulated in the United States by the Organotin Antifouling Paint Control Act of 1988. The Act prohibits the use of certain antifouling paints containing organotin and the use of organotin compounds, purchased at retail, used to make paints. The Act prohibits the application of antifouling paints to vessels less than 25 meters in length, with the following exceptions: the aluminum hull of a vessel less 25 meters in length or the outboard motor or lower drive unit of a vessel less than 25 meters in length. All antifouling paints must be certified by the Administrator of USEPA not to have a release rate of more than 4.0 micrograms per square centimeter per day.

Dredging activities (Section IV.D.1.c) associated with maintenance dredging and deepening of channels, and creation of ports, marinas, and private docks will continue to impact the Gulf's coastal waters. A number of maintenance dredging projects are ongoing, especially in the Mississippi River passes area, other navigation channels, and along the GIWW. Dredging activities are expected to result in localized impacts (primarily elevated water column turbidities) occurring over the duration of the activity (up to several months). Such activities would preclude some recreational and commercial water uses within the immediate area of this activity. The time periods for expected dredging operations will generally allow for the recovery of affected areas between such activities. Impacts are expected to be somewhat higher in the Mississippi Delta area because of higher sediment inputs.

Oil field wastes generated from coastal and offshore oil and gas development activities and disposed of in the Louisiana coastal area have contaminated groundwater and coastal water quality. As of November 1989, the State of Louisiana's Department of Natural Resources (DNR), Conservation Division, has identified 13,000 oil field pits that contain a variety of oil field waste chemicals (McCarthy, personal comm., 1989). Interagency projections of the total number of pits estimate the number of pits to be higher, closer to 20,000 dug in the last 10 years. Until recently, these pits were unlined and resulted in degradation of usable ground water through seepage of their constituents (USEPA, 1988). State regulations are currently in place which set forth more stringent requirements on pit operators and have led to the closure of many pits statewide. The USEPA documented a number of cases of damage caused by these reserve pits, both those illegal and those legal under Louisiana law. The USEPA documented cases have been extensively reviewed and corrective action taken in the form of new regulations or improved oilfield operating practices. According to USEPA, these documented damages suggest that all major types of oil field waste and waste management practices have been associated to some degree with endangerment of human health and damage to the environment. The principal types of wastes responsible for damage cases include general reserve pit wastes (drilling fluids and cuttings, pipe dope, rigwash, diesel fuel, and crude oil), fracturing fluids, production chemicals, waste crude oil, produced waters, and miscellaneous wastes associated with oil field exploration, development,and production (USEPA, 1988). Furthermore, the State of Louisiana has in the past allowed the direct discharge of waste drilling mud and produced water into bays and estuaries of the Gulf of Mexico. There are documented cases of environmental damage to oyster beds and thereby water quality from this practice (USEPA, 1988). The OCS oil industry has contributed to this problem because of its practice of coastal disposal of some produced waters (discussed below) and certain types of oil field waste, such as oil-based drilling fluids.

In the past, produced waters discharged from State oil and gas activities have been substantial and have had adverse effects at many of the discharge sites. In 1986, 1,524,962 BPD of produced water were discharged from 682 separation facilities associated with the Louisiana State oil and gas industry (Boesch and Rabalais, 1989a, b). In this report, it was estimated that another 823,575 bbl of produced waters from Texas State oil and gas activities were discharged daily into Texas State waters. It is anticipated that elevated levels of salinity (50-150 ppt), dissolved and dispersed petroleum hydrocarbons (10-50 ppm), organic acids, radionuclides, and trace metals may result around discharge sites. Concentrations of the organic constituents will depend on the separation and treatment technologies employed. Substantial hydrocarbon contamination of fine-grained sediments may extend out from several hundred meters to over one kilometer from the point of discharge. Concentrations of aromatic hydrocarbons in sediments may exceed background levels by over an order of magnitude. In March 1991, the Louisiana State Legislature approved regulations banning the discharge, into State waters, of all oil and gas activity derived wastewaters (primarily produced waters). The State's effluent guideline standards have been revised such that there shall be no discharge of produced waters into State waters after January 1, 1995, unless the discharge(s) are authorized in an approved elimination schedule or is in effluent limitation compliance. Based on this legislation, it is difficult to project the extent of impact, if any, of these future discharges.

It is assumed that 63 oil spills greater than or equal to 1,000 bbl will occur from import tankering in the Gulf of Mexico during the life of the proposal. Two such spills would additionally result from tankering crude oil from the TAP into the Gulf. The average size of an import tanker spill is estimated at 30,000 bbl. Of the import spills estimated, 31 are estimated to occur in nearshore waters and 21 in port areas within the northwestern (Texas) and northcentral (primarily Louisiana) Gulf of Mexico. The port areas expected to receive the greatest number of these spills include Houston/Galveston, the Louisiana Offshore Oil Port (LOOP), and Mississippi River ports. No ports within the northeastern Gulf (Florida) are presently receiving crude oil imports for refining; therefore, no import crude spills are assumed to occur in Florida port areas. Over 1,200 smaller spills (less than 1,000 bbl) are estimated to occur annually in nearshore and coastal areas throughout the Gulf of Mexico. Of these, 75 percent are assumed to be less than 10 bbl. This category of spill includes all oil and gas industry-related spills originating from the storage, production, and transportation activities. Another 77 spills (average size of 5,000 bbl) are estimated to occur from coastwise barging of crude oil, primarily in the Texas and Louisiana coastal areas. Most of these spills are expected to occur in the GIWW.

Within the Gulf's coastal zone, much of the existing infrastructure supporting offshore OCS oil and gas activities is distributed throughout coastal Texas and Louisiana. About 90 percent of the existing capacity or frequency usage of the oil industry infrastructure will support OCS operations in the future. The addition of 1 new pipe yard (coastal Mississippi/Alabama), up to 8 new pipeline landfalls (4 in coastal Texas, 2 in coastal Louisiana, and 2 in coastal Mississippi/Alabama), 320 km of onshore pipelines (160 km in coastal Texas, 80 km in coastal Louisiana, and 80 km in coastal Mississippi/Alabama), up to 6 new terminals (3 in coastal Texas), and 2 in coastal Louisiana, and 1 in coastal Mississippi/Alabama), and 1 new separation facility (coastal Mississippi/Alabama) are estimated to result from the cumulative OCS activities. Both the use of new oil and gas facilities once constructed and the use of the existing facility network would contribute to the number of effluents expected to be discharged into coastal waters from petroleum activities primarily in the Texas and Louisiana coastal zone. The construction and operation of onshore facilities supporting OCS activities may impact coastal and nearshore water quality by routine point and nonpoint source pollution. Increased effluent discharges from support facilities may contribute to point source pollution within coastal areas. These effluents are commonly discharged into surface waters after treatment. Surface runoff from existing OCS facilities is extensive and can adversely impact the surrounding area. Runoff from these facilities is likely to contain oil, brine, particulate matter, heavy metals, petroleum products, process chemicals, and soluble inorganic and organic compounds leached from the soil surface. Aside from adding contaminants to coastal waters, runoff from such facilities may alter circulation in wetland areas, and affect flushing rates and salinity gradients. Because the majority of the facilities expected to support offshore oil and gas activities are located in Texas and Louisiana, impacts of chronic discharges from these sources are expected to be focused there.

Vessel traffic associated with OCS oil and gas industry activities is expected to be extensive in the Texas and Louisiana coastal areas, especially within the Mississippi Delta area. Approximately 600,000 service vessel trips are estimated to support cumulative OCS activities. Waterways along the Louisiana coast where projected service vessel traffic will be the greatest include the Calcasieu River, Freshwater Bayou, the Atchafalaya River, and within the Mississippi River passes. The other navigation channels will have significant but lesser OCS vessel traffic. Import tankering and barge trips carrying both domestic and imported crude oil and products between terminals and refineries along the GIWW, adjoining navigation channels, and along coastal nearshore fairways will add to this traffic. Shuttle tankering associated with OCS production will not be significant; up to 2 percent is expected in association with the proposal (primarily offshore Texas). Discharges from service boats and barges, although diluted and discharged slowly over large lengths of channel, will be great enough to result in some degradation of water quality in the navigation channels and GIWW traversed. As noted in the base case, antifouling paints used on boats and tankers have been shown to have toxic effects on some marine biota. Increased loadings within coastal waters of tributyltin and copper compounds contained in antifouling paints are expected. Ballast and bilge waters from shuttle tankers are assumed to be discharged at onshore reception facilities and are not expected to impact coastal water quality. Operational discharges from shuttle tankering offshore are expected to add to the overall hydrocarbon contamination of nearshore open waters. Tarballs formed from these service vessel discharges will impact the Gulf's coastal beaches. Because no new service base locations are projected for OCS activities, and none is likely for State activities, operational discharges associated with OCS service vessel traffic will not impact coastal water quality. Impacts from such sources are substantial enough to cause low-level effects when discharged into confined waters over a long time period. Impacts to open waters are expected to be negligible, not causing changes in water quality characteristics.

Onshore produced water discharges originating from OCS oil and gas activities could have a detrimental effects at the discharge sites. In MMS funded studies completed by LUMCON (Boesch and Rabalais, 1989a, b; Rabalais et al., 1991), elevated concentrations of polynuclear hydrocarbons were found in sediments within a kilometer of the discharge sites. Total amounts of OCS produced waters expected to be piped ashore for separation, treatment, and disposal over the 45-year life of the proposed program are 3.14 billion bbl (approximate average of 200,000 bbl/day). Because of the recent Louisiana legislation concerning produced water discharges, most of these waters will be piped ashore for separation and treatment then reinjected onshore, treated and discharged into the Mississippi River, or treated and piped back offshore for discharge into marine waters. Most of the 11 sites produced water discharged sites discussed in the Boesch and Rabalais study are either discontinuing their operations or modifying their sites for reinjection or transmission of these waters back offshore. At sites continuing the practice of coastal discharge up to January 1, 1995, it is anticipated that elevated levels of salinity (50-150 ppt), dissolved and dispersed petroleum hydrocarbons (10-50 ppm), organic acids, radionuclides, and trace metals may result around discharge sites. Concentrations of the organic constituents will depend on the separation and treatment technologies employed.

Substantial hydrocarbon contamination of fine-grained sediments may extend out from several hundred meters to over one kilometer from the point of discharge. Concentrations of aromatic hydrocarbons in sediments may exceed background levels by over an order of magnitude.

Under the cumulative scenario, two oil spills (one 20,000-bbl platform spill and one 25,000-bbl pipeline spill) would occur offshore Texas, seven oil spills (three 20,000-bbl platform spills and four 25,000-bbl pipeline spills) would occur in the northcentral Gulf offshore Louisiana/ Mississippi/Alabama, and one 25,000-bbl pipeline spill would occur in the northeastern Gulf offshore Florida. Considering the locations of oil pipelines and platforms offshore, and the pattern of coastal ocean currents, the most likely location for contact from one of these spills is along a stretch of coast extending from western Louisiana to eastern Texas. A second spill, originating in the northeastern Gulf offshore Florida, is assumed to contact the Mississippi/Alabama coast. Because of the prevailing currents offshore northwest Florida, no spill (1,000 bbl or greater) contacts are assumed for the northwest Florida coast, but rather contact is assumed to occur along the Mississippi/Alabama coast (Gulf Islands National Seashore) and within the Mississippi Sound area. For both spills, it is assumed that as much as 75 percent of the original volume of oil from the spill source will be lost as a result of weathering processes by the time the slick contacts the coast. It should be noted that there could be some effects if residual weathered oil reaches coastal waters following a spill event, primarily in the form of tar material. Impacts from low-level contamination were discussed earlier.

It is further assumed that 37 oil spills (greater than 50 bbl and less than 1,000 bbl) and 985 oil spills (greater than 1 bbl and less than or equal to 50 bbl) could occur from OCS pipeline, platform, and transportation sources Gulfwide. Of these, it is assumed that fewer than 50 spills (greater than 1 bbl and less than or equal to 50 bbl) and fewer than 7 spills (greater than 50 bbl and less than 1,000 bbl) would contact coastal and estuarine waters. An additional 152 oil spills (less than 50 bbl) are assumed to occur from onshore support activities. Seventy-five percent of these are assumed to be less than 10 bbl. As indicated previously, petroleum hydrocarbons introduced into marine and coastal waters may have varied effects depending on the resource impacted, stage of weathering, and local physical and meteorological parameters. Some crude oil components are highly toxic and may cause damage to marine organisms due to the crude's aromatic content. It is anticipated that normal weathering processes encountered will detoxify the oil by breaking down the toxic components of the oil. Background levels in the Gulf of Mexico were reported at 0-70ug/l. In shallow areas, oil may become entrained in suspended particles and bottom sediments, subsequently being reintroduced into the water column. Based on these estimates and the frequent nature of spills over the life of the proposal, the effect of hydrocarbon contamination on the Gulf's coastal waters due to the proposed action is considered negligible, with water characteristics rapidly returning to background levels within several days to weeks.

In summary, routine point and nonpoint source discharges from non-OCS activities, such as agriculture, general construction projects, hydromodification, silviculture, septic tank leakage, urban runoff, and especially oil and gas activities will degrade coastal and estuarine waters within the Gulf of Mexico's coastal zone. In addition, maritime activities are expected to contribute to the degradation of waters near ports and major navigation channels. Total hydrocarbon concentrations measured in Gulf of Mexico oyster and sediment samples from the USDOC, NOAA Status and Trends Program were generally lower than hydrocarbon concentrations at east and west U.S. coast locations, probably because the sites in the Gulf are farther removed from point sources. The following conclusions about hydrocarbon contamination can be made from the study: (1) chronic petroleum contamination is taking place, possibly from oil and gas operations along the Gulf of Mexico coastline, but also due to contamination of the discharge from the Mississippi River; and (2) water quality degradation is not taking place to such an extent to show marked increases over U.S. coastal areas that do not have as many oil operations.

All existing onshore infrastructure and associated coastal activities occurring in support of proposed action will contribute to the degradation of regional coastal and nearshore water quality to a minor extent because each provides a low measure of continuous contamination and because discharge locations are widespread throughout the Gulf Region. The effect of chronic contamination on the Gulf's coastal waters due to the proposed action is considered negligible, with water characteristics rapidly returning to background levels. OCS-related vessel traffic are likely to impact water quality through routine releases of bilge and ballast waters, chronic fuel and tank spills, trash, and low-level releases of the contaminants in antifouling paints. Depending on the length of the affected channel, flushing rates, etc., it is expected that there will be some localized short-term change (up to several weeks) in water quality characteristics from background levels. OCS produced water discharges will have localized impacts at those site which continued their coastal discharge practice up to January 1, 1995. The Mississippi River Delta area will receive the greatest amount of these discharges. It is anticipated that elevated levels of salinity (50-150 ppt), dissolved and dispersed petroleum hydrocarbons (10-50 ppm), organic acids, radionuclides, and trace metals may result around produced water discharge sites. Substantial hydrocarbon contamination of fine-grained sediments may extend out from several hundred meters to over one kilometer from the point of discharge. The improper storage and disposal of oilfield wastes and contaminated oilfield equipment would adversely impact surface and ground waters in proximity to disposal facilities, cleaning sites, and scrap yards. Surface and groundwater in proximity to improperly designed and maintained disposal sites and facilities could be adversely impacted with elevated concentrations of arsenic, chromium, zinc, cadmium, mercury, lead, barium, penta-chlorophenol, naphthalene, benzene, toluene, and radium.

Accidental spills will introduce oil into nearshore waters, creating elevated hydrocarbon levels (up to 100+ug/l) within affected waters. Much of the oil will be dispersed throughout the water column over several days to weeks. In shallow areas, oil may become entrained in suspended particles and bottom sediments. Water uses would be affected for up to several weeks from proposed spills and then only near the source of slick. Other spills will occur from import tankering (including oil from the TAP), transporting oil products throughout the Gulf, barging crude oil, etc. Refined oils are considered more toxic than crude due to the higher concentration of aromatic hydrocarbons and their greater ability to dissolve and disperse into the water column as a result of their less viscous nature. Products such as gasoline and kerosene are likely to cause biological damage due to its toxicity over a relatively short period of time.

MARINE WATERS: This cumulative analysis considers the effects of impact-producing factors related to the proposed action, plus those related to tankering and other vessel traffic, the Strategic Petroleum Reserve Program (SPRP), and industrial waste disposal activities that may occur and adversely affect the offshore water quality in the northern Gulf of Mexico. Specific types of impact-producing factors considered in the analysis include well-drilling discharges, pipeline emplacement, hydrocarbon production formation waters, dredging, accidental oil spillage, routine operational discharges, ocean disposal of hazardous material, and industrial waste discharges.

Vessels vary in size and design as much as in function. Vessels range from small recreational craft used primarily in coastal waters to defense-related naval vessels and ships of the merchant marine fleet up to several hundred thousand tons in size. With respect to ships that maintain sizable crews, the pollutants are the large amounts of domestic waste products such as sewage, food waste, and trash from the human activities on board. For recreational vessels, sewage disposal from marine sanitation devices in highly populated, confined harbors and anchorages is the primary pollution concern. Other problems are related to the movement of crude oil and concern offshore unloading terminals (deep-water ports) and identification of systems most reliable for transfer of oil from OCS production areas to shoreside facilities. Perhaps the most publicized source of pollution is the operational discharge of oil by tankers in the merchant marine fleet. In 1979 alone, an estimated 2.5 million gallons of petroleum hydrocarbons were discharged from ships operating within the Gulf under normal operating conditions (USDOC, NOAA, 1985a). Regulations, coupled with the increased value of oil, have led to development of new and better techniques, such as segregated ballast, crude-oil washing systems, and oil/water separation systems for minimizing contamination of ballast water. Nevertheless, enforcement of regulations and standards is still a problem.

Between 1946 and 1970 the Atomic Energy Commission (AEC) licensed the dumping of more than 86,000 containers of low-level radioactive wastes at 28 recorded dumpsites in the Atlantic and Pacific Oceans and the Gulf of Mexico. Of these, only 2 dumps were made in the Gulf of Mexico (USEPA, 1980b). Ocean dumping was discontinued in June 1970 following a policy recommendation by the President's Council on Environmental Quality (CEQ) in its 1970 report to the President. The United States has never disposed of its high-level wastes in the oceans, and in 1972 two major legislative initiatives were enacted prohibiting future disposal of high-level wastes into coastal waters and rivers. The Ocean Dumping Act, in addition to regulating ocean disposal of low-level waste, prohibits the dumping of high-level waste and radiological warfare agents in ocean waters. Soon after the Ocean Dumping Act was enacted, the Clean Water Act was amended to extend the prohibition to all navigable waters.

A concentrated brine solution needing disposal results from the development and operation of salt-dome storage cavities associated with the SPRP, which is mandated by the Energy Policy and Conservation Act of 1975 (42 U.S.C. §6201 *et seq.*). The brines are normally discharged into the Gulf of Mexico through diffusers to promote rapid dilution to background salt concentrations. However, the brines are denser than seawater and tend to flow along the seafloor, affecting bottom-dwelling organisms until sufficient dilution has been achieved. In addition, hydrocarbons and other harmful constituents may be dissolved in or entrained with the brine discharge. Brine discharges are regulated by USEPA under NPDES.

Offshore sulphur operations off Louisiana have been ongoing since 1954. As with oil and gas activities, potential wastewater degradation resulting from sulphur mining operations will be governed by numerous factors. Bleedwater is by far the largest quantity of waste discharged during normal operations. Bleedwater is typically discharged directly into surface waters and the dissolved solids in these streams closely approximate those of seawater. Sulfide in bleedwater will have a brief presence once discharged. Based on years of testing by Freeport McMoran at its Grand Isle Mine, data indicate that bleedwater is not measurable at 300+ feet from the source. Accidental spills of molten sulphur would have a minimal impact on nearshore or offshore water quality. Impacts to water quality within the Gulf are expected to be negligible.

Spills from import tankering (average spill size 30,000 bbl) and Gulfwide OCS activities may affect offshore water quality as indicated (see discussion in Section IV.D.1.c). It is assumed that 63 oil spills greater than or equal to 1,000 bbl will occur from import tankering in the Gulf of Mexico during the life of the proposal. Two such spills would result from transporting crude oil from the TAP into the Gulf of Mexico.

As indicated in the base case, immediate effects would be brought about by increased drilling, construction and pipelaying activities, causing an increase in water column turbidities to the affected offshore waters. Pipeline construction activities may result in the resuspension of some 26.5 million yd^3 of sediment during the installation of an estimated 3,200 km of pipelines in water depths of 200 ft and less. Offshore Texas and Louisiana will support the greatest portion of program-related pipeline burial activities and associated sediment resuspension, with 10 million yd^3 and 14 million yd^3, respectively. Pipeline construction activities may result in the resuspension of settled pollutants, toxic heavy metals, and pesticides, if present. Impacts resulting from resuspension of bottom sediments following an explosive structure removal include increased water turbidity and mobilization of sediments containing hydrocarbon extraction waste (drill mud, cuttings, etc.) in the water column. The discharge of NPDES regulated treated sanitary and domestic wastes from the various rigs and platforms will increase levels of suspended solids, nutrients, chlorine and BOD near the point of discharge. These are considered minor discharges and are quickly diluted. Treated deck drainage and domestic wastes are most often taken ashore for proper disposal at an approved site. Up to 15.7 billion bbl of produced waters are estimated to result from cumulative OCS activities. Of this, 12.56 billion bbl will be discharged offshore. Offshore Texas and Louisiana will receive the greatest number of these discharges with 2.5 billion bbl and 9.9 billion bbl, respectively. Based on the findings of investigators, the anticipated effects of these discharges on offshore water quality will be limited to an area in proximity to the discharge source. Approximately 138.46 million bbl of drilling muds and 33.44 million bbl of drill cuttings are assumed to result from drilling activities associated with the cumulative OCS activities. Drilling muds and cuttings are routinely discharged into offshore waters and are regulated by NPDES permits. In addition to those muds discharge disposed of offshore, it is assumed that 18 percent of the muds used offshore (approximately 24.92 million bbl) will be brought ashore for disposal. As with produced water discharges, offshore Texas and Louisiana would receive the greatest percent of these potential discharges. An estimated 45.84 million bbl of drilling muds and 13.7 million bbl of drill cuttings would be discharged offshore Texas; whereas, offshore Louisiana an estimated 63.2 million bbl drilling muds and 18.35 million bbl of cuttings could be discharged. When discharged into the surrounding offshore waters, drilling muds may create turbidity plumes several hundred meters in length. Studies indicate that these impacts are restricted to an area within 300 to 500 m of the discharge site. Dilution is extremely rapid in offshore waters. A 1983 NAS study suggests that for routine oil and gas discharges, the various components measured—including turbidity, are at background levels by a distance of 1,000-2,000 m. As in the base-case analysis, the natural processes of dispersion, degradation, and sedimentation will result in immeasurably low concentrations of these materials within a few meters to a few kilometers of the discharge site.

Spills of hazardous materials may, in many cases, pose a more serious threat to marine ecosystems than oil spills. Substantial amounts of oil and hazardous materials enter the marine environment as a result of accidental spills. The base case analyzes the severity of oil spills to water quality in general. Program related spills are discussed in the previous section under Coastal/Estuarine Water Quality. It is assumed that 169 petroleum product spills (11,000 bbl in size) will occur Gulfwide related to OCS activities. As previously noted refined oils are considered more toxic than crude due to the higher concentration of aromatic hydrocarbons and their greater ability to dissolve and disperse into the water column as a result of their less viscous nature. Products, such as gasoline and kerosene, are likely to cause biological damage due to its toxicity over a relatively short period of time. Although the focus in the past has been on the cleanup and mitigation of spilled oil, national concern has been shifting toward hazardous materials as the cause for most immediate concern. Much has been learned in the past 10 years about how to respond to oil spills; far less is known for spills of hazardous material. Unlike oil, whose properties are fairly uniform, hazardous materials have a wide variety of physical and chemical forms, complicating and making the response necessary for their cleanup and disposal much more difficult. Methods for the cleanup and mitigation of hazardous materials are not well established.

In summary, those activities which would impact the Gulf's marine waters would include marine transportation and OCS oil and gas activities. Vessels range from small recreational craft used primarily in coastal waters to defense-related naval vessels and ships of the merchant marine fleet up to several hundred thousand tons in size. Pollutants from vessel traffic include large amounts of domestic waste products such as sewage, food waste, and trash from the human activities on board. Other problems are related to the movement of crude oil and concern offshore unloading terminals (deep-water ports).

With regard to OCS activities, immediate effects would be brought about by increased drilling, construction and pipelaying activities, causing an increase in water column turbidities (lasting for several hours with mud discharges to several weeks with dredging-pipelaying activities) to the affected offshore waters. The magnitude and extent of turbidity increases would depend on the hydrographic parameters of the area, nature and duration of the activity, and bottom-material size and composition. Offshore Texas would receive the greatest portion of program-related pipeline burial activities, whereas, offshore Louisiana would receive the largest amounts of program-related operational discharges. Because of the continuous nature of oil and gas activities in the northwestern and northcentral Gulf of Mexico, the frequency of drilling mud and cutting and produced water discharges is judged to occur nearly continuously throughout these areas. Proposed produced water discharges will be rapidly diluted within the immediate vicinity of the discharge source. Significant increases in water concentrations of dissolved and particulate hydrocarbons and trace metals are not expected outside the initial mixing zone or immediate vicinity of the discharge source. Higher concentrations of trace metals, salinity, temperature, organic compounds, and radionuclides, and lower dissolved oxygen may be present near the discharge source. Long-term effects to water column processes, consisting of localized increases in particulate metal and soluble lower molecular weight hydrocarbons (e.g., benzene, toluene, and xylenes) concentrations, may be implicated within the mixing zone of the discharge. Trace metals and hydrocarbons associated with the discharge may be deposited within sediments near the discharge point. The proposed discharge of drilling fluids and cutting would encounter rapid dispersion in marine waters. Discharge plumes will be diluted to background levels within a period of several hours and/or within several hundred meters of the discharge source. The accumulation of toxic trace metals and hydrocarbons in exposed shelf waters, due to periodic releases of water-based generic muds and cuttings, are unlikely and the long-term degradation of the water column from such discharges are not major concerns. Few effects are anticipated to most water uses from routine activities and discharges and then only in an area near the source.

Program-related and non-related crude oil spills will introduce oil into offshore waters and create elevated hydrocarbon levels (up to 100+ug/l) within affected waters. Much of the oil will be dispersed throughout the water column over several days to weeks. Little effect to water use is anticipated from these spills and then only in an area near the source and slick. Other spills will occur from import tankering (including oil from the TAP), transporting oil products throughout the Gulf, barging crude oil, etc. Refined oils are considered more toxic than crude due to the higher concentration of aromatic hydrocarbons and their greater ability to dissolve and disperse into the water column as a result of their less viscous nature. Products such as gasoline and kerosene are likely to cause biological damage due to its toxicity over a relatively short period of time.

CONCLUSION: Overall cumulative impacts, which include the effects of non-OCS-related factors (routine point and nonpoint source discharges from agriculture, general construction projects, hydromodification, silviculture, septic tank leakage, urban runoff and State oil and gas activities) and OCS activities will significantly degrade water quality, primarily within the Gulf of Mexico's coastal zone in highly urbanized and industrialized coastal areas. Maritime activities are expected to contribute to water quality degradation near ports and major navigation channels. In restricted or poorly flushed coastal waterbodies, localized increases in pollutant concentrations (nutrients, organic matter, trace metals, organotins, hydrocarbons, etc.) may be severe and persist for months or longer. Low dissolved oxygen levels will result in localized hypoxia in the coastal and nearshore waters. As indicated above, water quality degradation will be less noticeable in marine waters and well flushed coastal water bodies due to rapid dilution and dispersion of contaminants. Chronic, low level pollution will continue to persist in marine and coastal waters. The cumulative effects of the proposal are expected to result in significant changes to the ambient concentration of one or more water quality parameters, up to several hundred meters from the source of activities and for a period lasting up to several weeks or months in duration. In marine waters and well flushed coastal water bodies this change will be less noticeable due to rapid dilution and dispersion of contaminants. Chronic, low level pollution related to the proposal will occur throughout the 45-year life of the proposal.

(b) Alaska Region

Impact-producing agents that are most likely to affect water quality in coastal Alaska are offshore placer mining in State waters, onshore mining and mineral processing, local harbor dredging, and non-oil-industry spillage of petroleum products in Alaskan rivers and coastal communities and existing and potential State and Federal offshore and onshore oil and gas activities. In the future, two large gold dredges and one small gold dredge are projected for State waters in Norton Sound. These three dredges would affect water quality in a similar manner as indicated for mining in Federal waters.

The annual Nome Harbor dredging and offshore discharge of spoils of 5,000 yd^3/yr by the Army Corp of Engineers may add some additional risk of pollution, but only in the years when the basin is dredged (USDOI, MMS, 1991a). This is the result of past mercury and arsenic contamination of the Snake River watershed by mercury-amalgamation, dredging and the processing of gold.

Non-oil-industry spills of petroleum products of a few to several hundred barrels are relatively common in Alaska. Based on MMS oil-weathering and spreading models, small non-oil industry-spills would affect water quality within a few tens of kilometers of the spill sites.

Activities associated with existing and potential State and Federal offshore oil and gas activities that are most likely to affect coastal water include causeways, pipeline dredging, gravel island-construction and -removal, deliberate discharges, and oil spills (see Section IV.D.1.c).

Four causeways currently exist in the Beaufort Sea as a result of State oil and gas development: at both sides of Prudhoe Bay, at Oliktok Point, and at the Endicott Development. In addition, four causeways may be necessary to bring Beaufort Sea oil pipelines ashore at Point Belcher, Pitt Point, Oliktok Point, and Point Thomson. Other causeways are possible to allow supply of offshore drilling/production operations in ANWR and the NPR-A. Causeways are not anticipated to be developed in the Bering Sea, Cook Inlet, or Gulf of Alaska.

Causeways locally affect turbidity through enhanced sedimentation of suspended loads and through redirection of flow of water masses carrying suspended loads and by lengthening the period of ice cover within about a 5-km distance. The redirection of the flow also changes local temperature and salinity regimes. The effect of these causeways on the water quality of the Beaufort Sea is limited to about a 5-km distance offshore of each causeway, but the total area affected could be greater than 1,000 km^2.

The only dredging activity that is expected to affect water quality, in addition to that anticipated for the proposal, is pipeline trenching on existing Federal leases in the Beaufort and Chukchi Seas. If oil is found, 600 miles of offshore pipeline could be emplaced in the Beaufort Sea (Sale 124) and 550 to 600 miles of pipeline in the Chukchi Sea (Sale 126). Trenching and dumping of dredged spoils would disturb about 37 mi^2 in the Beaufort Sea and 34 to 37 mi^2 in the Chukchi Sea. Trenching and dumping of dredged spoils associated with pipeline placement for the proposal would disturb about 17 mi^2 in the Beaufort Sea, 15 mi^2 in the Chukchi Sea, 2 mi^2 in Cook Inlet, and 6 mi^2 in the Gulf of Alaska. Pipelines from development in State waters would be short and in waters that are already naturally turbid over much of the summer.

Prior to any discharge, site-specific discharge of dredge or fill material into U.S. waters will be evaluated in followup environmental documents as required. Because dredging occurs at a rate of about 1.3 km/day, the extent of the turbidity plumes from each pipeline constructed would be about 3.9 km^2 at any one time (a 1.3-km by 3-km area). Over the actual period of pipeline dredging, perhaps an equal area would be affected by turbidity from dumping on a daily basis. Dumping of dredged spoils is not expected to introduce or mobilize any chemical contaminants.

The joint Federal/State Seal Island/North Star oil and gas unit is likely to be developed without causeway construction. Any gravel islands constructed on inshore State leases would require relatively little gravel compared to the above projects as long as causeways were not included. Any of these construction projects could be completed within one or two summers, and turbidity effects in the vicinity of the construction activity would be short term and local.

A gravel island would require a mined-gravel volume of 645,000 cubic meters if in 15 meters of water. Gravel would be carried by barge to the construction site during summer. About 20 barge loads a day, each of 1,200 cubic meters of gravel, would be required over a 25- to 30-day period to construct the island. A total area of 7 square kilometers could be affected by increased turbidity for some part of the time.

Fifteen gravel islands, mostly in State waters, have been constructed during past oil and gas exploration in the Beaufort Sea. During its useful life, an artificial island would be protected from erosion by sandbagging or rock-armor emplacement. If exploration from the artificial island were unsuccessful, the sandbags would be removed and the island itself would be abandoned or removed.

Removal of a gravel island would result in a temporary increase in turbidity similar to that discussed for dredging. If the island were abandoned, storms, ice override, and ice gouging would erode the island over a period of several years. During this time ocean currents would winnow finer sediments from the island into a plume detectable for about 1 to 3 km downcurrent. The area affected would be similar to that of the construction area. Turbidity levels would be lower than during construction, but increased turbidity could persist for several years. Abandonment could result in local but persistent turbidity plumes as the island eroded.

Routine discharges of muds and cuttings resulting from continued exploration and development on existing leases in the Chukchi Sea and Beaufort Sea would occur in addition to those expected from the proposal (Beaufort Sea, Chukchi Sea, Navarin Basin, St. George Basin, Cook Inlet, and Gulf of Alaska). Additional muds and cuttings could be discharged in State waters from leases in past and proposed State sales. Discharges from State and Federal leases during both exploration and development are regulated by USEPA. The concentration of trace metals in discharges would be within the marine water-quality criteria at 100 m from the discharge point. Reduced water quality would exist only during periods of actual exploration or development drilling discharge and would rapidly dissipate upon completion.

If formation waters were reinjected or injected into different formations, no discharge of formation waters would occur and no effect would occur. If formation waters were discharged, the effect on water quality would be limited to the mixing zone (100 m from the discharge point) and would continue for the duration of production in each planning area. In the cumulative case the discharge of formation waters in the Beaufort Sea, Chukchi Sea, Navarin Basin, St. George Basin, Cook Inlet, and Gulf of Alaska would degrade water quality on less than 1 percent of each planning area.

In addition to permitted discharges, accidental oil spills are likely to occur. Seventeen spills of 1,000 bbl or greater are assumed in the Alaska Region from production activities off Alaska. In addition to the infrequent occurrence of spills, 2,017 chronic small spills ranging from 1 to 999 bbl also are assumed to occur.

Sustained degradation of water quality to levels above State and Federal criteria from hydrocarbon contamination is unlikely. Hydrocarbon concentrations from each of 17 oil spills of greater than 1,000 bbl could exceed the chronic criterion of 0.015 ppm total hydrocarbons on up to several thousand square kilometers for a short period of time (about 30 days). However, this would depend on the size, location, and season of the spill. The persistence of individual oil slicks would be short term (less than 1 year). The small spills under 1,000 bbl estimated to occur over the life of the fields would effect water quality within a few tens of kilometers of the spill sites.

In summary, local harbor dredging, non-oil-industry oil spillage and pipeline dredging, gravel island-construction and -removal, and normal discharges associated with existing and potential State and Federal offshore oil and gas activities could temporarily affect water quality in coastal Alaska. The reduction in water quality resulting from these activities would exist within tens of kilometers of the activity only during periods of actual construction or discharge and would rapidly dissipate on completion of the activity.

Causeways and oil spills could affect water quality on several thousand square kilometers. Beaufort Sea causeways would affect turbidity, local temperature and salinity regimes around about a 5-km distance offshore of each causeway, but the total area affected could be greater than 1,000 km^2. Water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for a short period of time (about 30 days).

CONCLUSION: Under the cumulative scenario, water quality would be reduced up to several thousand square kilometers from OCS and non-OCS activities within the Alaska Region over the 24 to 32-year life of the proposed action. The water quality would be temporarily affected by local harbor dredging, non-oil-industry oil spillage, pipeline dredging, gravel island construction and removal and, normal discharges associated with existing and potential State and Federal offshore oil and gas activities. This reduction in water quality would occur only during periods of actual construction or discharge and would rapidly dissipate upon completion of the activity. Accidental oil spills from OCS activities (17 spills) will reduce water quality up to several thousand square kilometers through hydrocarbon contamination for a short period of time (about 30 days per event).

(c) Pacific Region

Cumulative impacts on water quality would result when the proposed lease sale is added to other present and reasonably foreseeable actions in the Pacific OCS Region. Projects considered in this cumulative impact analysis are listed in Section IV.D.1.c. The projects that could most affect water quality are: 1) ocean dumping; 2) the Ports of Los Angeles/Long Beach 2020 Master Plan; 3) municipal wastewater discharges and other offshore effluents; 4) other offshore oil and gas exploration and development; and 5) Alaskan and foreign import tankering.

The impacts of offshore dumpsites are usually limited to the local surrounding area. The pollution resulting from dumpsite activities is similar to that resulting from the discharge of drilling muds and cuttings at drilling locations, with water quality parameters returning to background levels by a distance of 1,000-2,000 m from the dump site. Water quality parameters affected at the local level could include turbidity, dissolved oxygen, suspended solids, and trace metals. Some dump sites may also increase levels of radioactive or toxic materials. There are 38 designated historic and active dumpsites in the Southern California Planning Area, but none are located in the areas proposed for leasing.

The 2020 Master Plan constitutes a major action proposed to meet future cargo-handling demands projected for the Ports of Los Angeles and Long Beach. This project is expected to involve the dredging of approximately 172 million m^3 of dredge material during the development of new deep-water channels. Most of the dredged material will be used to create additional land for new terminal development, but substantial resuspension of sediment will occur during the dredging process. With the development of the new facilities, a nearly threefold increase in cargo tonnage is anticipated by the year 2020. Based on the 1986 Southern California Coastal Water Quality Research Project Report (SCCWRP, 1986), port activities generally cause a chronic deterioration of water quality in the local area, with increases in the levels of oil and grease, suspended solids, and trace metals being common. These effects will be concentrated within and in the immediate vicinity of the Los Angeles and Long Beach Harbors.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in Section IV.D.1.c. The water quality parameters affected by wastewater discharges include suspended solids, BOD, oil and grease, trace metals, and others. In the Pacific OCS Region as a whole, the volume of sediment from rivers (principally the Columbia River) is by far the largest component and easily overshadows all other sources, while the present municipal and industrial wastewater discharges are the largest source of pollutants in terms of concentrated input. Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986).

Cumulative impacts will also occur from routine effluents associated with offshore exploratory and development operations. Routine operational effluents include produced water, drilling muds and cuttings, and other routine discharges, such as deck drainage and treated sewage (Sections IV.D.1.a(1)). Resuspension of sediments will also occur during construction of platforms and pipelines and during many routine operations.

In the Southern California Planning Area, 48 platforms are assumed to be in place some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms on existing leases, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time. It is also assumed that existing or currently planned onshore support facilities, including an approved but unbuilt processing facility in San Luis Obispo County, will be constructed to accommodate oil produced in the northern Santa Maria Basin.

The effects of the effluents and resuspended sediments from these activities are expected to include some mortality of marine organisms within about 500 m of discharge sites and elevated levels of contaminants and turbidity within about 2,000 m of the OCS operations. Beyond these distances, mixing and dilution will rapidly reduce levels of water quality parameters to ambient concentrations. Extrapolating from the 7 platforms assumed for the proposal, the routine activities associated with the base case are expected to contribute about 15 percent of the effluents and sediment resuspension resulting from OCS activities in the Pacific Region over the 35-year life of the proposal. In comparison to existing municipal effluent discharges and sediment levels from runoff, additional OCS operations will contribute a very small portion of the present loading of sediments and pollutants into area waters, resulting in very little additional impact to the water quality of the Pacific Region.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on regional water quality. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

The Alaskan tanker route, transporting TAPS oil, lies approximately 45 miles off Cape Mendocino and nearly parallels the coastline of the Pacific Region north of Point Conception. Some of the tankers enter into Puget Sound and San Francisco Bay, while the rest continue to Los Angeles/Long Beach and to the Gulf of Mexico. The TAPS and foreign tankering and oil lightering contribute a significant risk of oil spills due to the large volume of oil transported.

It is assumed for the cumulative case that a total of 17 spills (ranging in size from 7,000 to 30,000 bbl) will occur in the Pacific Region over the 35-year life of the proposed action. This total includes 5 TAPS tanker spills, 5 import tanker spills, and 7 OCS spills. The OCS total includes a combination of spills from platforms, pipelines, and the tankering of Alaskan OCS oil. For purposes of analysis, it is assumed that the spill will occur with uniform frequency and spatial distribution within each planning area over the 30-year life of the proposed action. Therefore, the average number of spills per year in the Pacific OCS Region from all these sources is approximately 1 spill every 2 years.

The regional impact of oil spills on water quality from activities resulting from the base case, is discussed in Section IV.D.1.a(1). In the cumulative case, 10 oil spills (1,000 bbl or greater) are estimated from activities other than this proposal. The effects of oil spills from ongoing and projected oil and gas development activities in the Pacific Region will depend on the direction of the winds and currents and the point of origin of the spill.

Oil spills impact water quality primarily at local and sub-regional levels. The parameters affected include oil and grease, dissolved oxygen, turbidity, trace metals, and others. In the cumulative case, local impacts will be far more important than regional impacts. Based on the previous water quality impact analyses in the base-case section, individual oil spills will elevate hydrocarbon levels (up to 100ug/l) over an area of one or two thousand square kilometers and limit waters uses within the affected area over a period of weeks.

It is assumed for purposes of the analysis, that the number of oil spills in the Pacific Region will occur with uniform frequency and spatial distribution over the 35-year life of the cumulative scenario. If the additional assumed spills occurred during discrete times over the 35-year life of the proposed action, they would result in a series of impacts to the water quality of a non-overlapping nature, allowing the water quality to recover to the pre-spill level. If two or more spills did overlap in time and space, there would be a chronic impact that might result in a higher impact.

In the cumulative scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the spills discussed above, and are not expected to make a measurable contribution to impacts on regional water quality.

CONCLUSION: It is expected that water quality will continue to be good to excellent in most marine waters in the Pacific Region. Runoff from streams and rivers will continue to overshadow all other sources of pollutants in the Pacific Region. Municipal and industrial wastewater discharges will remain the major source of concentrated pollutants in the marine environment, particularly in the Southern California Bight. The discharge from routine offshore exploratory and development activities will have a negligible effect on water quality. Accidental oil spills will impact water quality over areas of a thousand square kilometers or more for periods of several weeks, but are not expected to contribute to chronic degradation of water quality in the region.

(d) Atlantic Region

Water quality impacts resulting from routine OCS activities are described in the base-case scenario (see Section IV.D.1.a(1)), where it was concluded that offshore water quality would only be affected within the immediate vicinity of discharge sites and would return to ambient conditions within a few hours after discharges cease. Activities at onshore support bases were also determined to have no significant effect on inshore water quality. In the cumulative-case scenario, which is described in this section, water quality impacts for the Atlantic coast during the next 30 years resulting from OCS and non-OCS activities will be evaluated. The impacts on water quality caused by oil spills from tankers carrying imported petroleum and petroleum products will also be considered.

Potential causes of impacts on water quality resulting from routine onshore and offshore OCS activities are described in the base-case scenario (Section IV.D.1.a(1)). Causes include construction, maintenance, and routine activities at onshore support facilities, gas processing plants, and offshore wells and platforms. Other factors affecting inshore water quality include discharges from offshore support vessels while in coastal waters, construction of gas pipelines, and channel dredging. Potential causes of water pollution offshore include the discharges of drilling muds and cuttings, formation water, domestic and sanitary wastes, and sediment disturbance associated with deploying and construction of offshore platforms.

Potential effects on water quality from the discharge of drilling muds and cuttings are controlled by depth, composition, and amount of discharge (see Section IV.A). The most important factor affecting these properties is the stage of drilling. During the early stage of drilling, e.g., before the marine riser is in place, discharges occurs at the seafloor and consist primarily of seawater and cuttings. Infrequent "slugs" of drilling muds may also be added to drilling fluids, as needed, and would also be discharged at the sea floor. After the marine riser is in place, however, muds and cuttings are recirculated and are discharged near the surface at the end of well drilling, or stored for future use.

During the next 30 years, pollution associated with population growth, particularly in the southeast (Culliton et al., 1990), is expected to continue as an important factor affecting water quality in Atlantic coastal waters and estuaries. Casco Bay, Penobscot Bay, Boston Harbor, western Long Island Sound, Hudson River/Raritan estuaries, Delaware Bay, and St. Johns River are expected to remain degraded with respect to water quality (see Section III.D.1.c).

Other potential causes of water pollution during the next 30 years include inactive and active dump sites, and mining and dredging activities. Dump sites include inactive industrial, sludge, radioactive, and munition sites, and active dredge spoil sites (see Section IV.D.1.c). Offshore mining during the next 30 years is expected to include one or more the following non-energy mineral resources: sand, gravel, manganese, and phosphates.

Marine vessel traffic is expected to increase as a consequence of continued population growth in coastal areas during the next 30 years. Nearshore and offshore vessel traffic contributes to water quality degradation through operational discharges including small fuel spills, fuel tank washings, and deck drainage.

Additional causes of water pollution under this scenario include accidental oil spills. Small operational oil spills are a major cause of temporary and local water quality degradation in inshore waters. In addition, thirteen oil spills (greater than or equal to 1,000 bbl) from the importation of foreign crude oil (less than 1,000 bbl) are projected to occur during the 40 years covered by this scenario. These spills are expected to originate from tanker transport of imported oil and oil products. Of the 13 oil spills, 12 are projected to occur in the mid-Atlantic, 1 in the south Atlantic, and 4 are projected to occur while the tankers are in port. The principal factors affecting water quality from oil spills are discussed in the base case (Section IV.D.1.a(1)). These factors include type of oil (e.g. fuel oil or crude oil) and location of the spill. Oils with higher volatile fractions are expected to have a greater effect on water quality than crude oil containing less volatile hydrocarbons. However, the persistence of oil in the environment and, therefore, the prolongation of possible impacts of the oil on water quality depends on environmental factors such as sea and air temperature, and ocean currents and turbulence.

The potential impacts on water quality from routine inshore and offshore discharges associated with OCS activities are discussed in the base case (Section IV.D.1.a(1)). Water quality parameters that are expected to be affected by routine discharges include DO, COD, BOD, turbidity, trace metals (including heavy metals), nutrients, salinity, radionuclides, and toxic chemicals.

The effects of routine discharges on water quality on the OCS are expected to be limited to the vicinity of the discharge within a 1,000 m (3,280 ft) and are expected to affect water quality parameters for a few hours or less. The impact of allowable discharges on water quality is expected to be low because of USEPA-NPDES limitations on domestic, sanitary, and drilling discharges, the rapid dilution and dispersion of formation water and drilling muds in the marine environment, and the relatively low toxicity of allowable discharges.

The effects on water quality from the discharge of drilling muds and cuttings are discussed in the base case (see Section IV.D.1.a(1)). The magnitude of currents and turbulence in the water column determines the speed at which drilling muds disperse and their effect on water quality. Effects of turbidity extend approximately 800-1,000 m (2,624-3,280 ft) beyond the discharge site. Within 40 m (130 ft) of the discharge site, temperature and pH may also rise slightly and salinity and DO may decrease (USDOI, MMS, 1988a).

The effects on water quality from the discharge of formation waters are discussed in the base case Section IV.D.1.a(1)). Formation waters dilute rapidly in seawater and their effect on water quality is limited to the immediate vicinity of the discharge site.

The impact of domestic and sanitary wastes on water quality are discussed in the base case (Section IV.D.1.a(1)). The effect of these discharges on water quality is restricted to the immediate vicinity of the discharge site and is expected to dissipate within a few hours. As with formation waters, the discharge of such wastes offshore are regulated by the USEPA-NPDES permit system.

Inshore and offshore construction are expected to temporarily affect water quality by increasing turbidity. Jetting and burying of an additional gas pipeline and the construction of an additional gas processing plant, assumed under this scenario, are expected to generate turbidity and possible release of heavy metals from sediments. The effects of increased turbidity on water quality are expected to last a few hours to a few days, depending on circulation and sediment composition within the estuary. Runoff from onshore construction may also impact water quality by increasing turbidity.

It is expected that the major population and industrial centers on the Atlantic coast will continue to be the principal sources of potential water pollution during the next 30 years. The primary causes of water pollution from non-OCS sources include nutrients, turbidity, organic carbon, DDT and other pesticides, PCBSs, PAHs, and heavy trace metals.

Water pollution control efforts including regional projects (e.g. Chesapeake Bay), projects to upgrade sewage treatment (e.g. Boston Harbor Waste Water Conveyance System), and other pollution control measures by Atlantic coastal cities are likely to reduce the impact on water quality from increases in population along the Atlantic coast. Most of the population increases, and resulting impacts on water quality, are expected in the south Atlantic states (Culliton, et al. 1990).

Inactive industrial and sludge dump sites on the inner shelf and OCS will continue to be sources of water pollution and will affect local water quality on the shelf for a number of years to come. Studies at the 106-mile dump site indicate that during low current conditions, water quality parameters in surface waters are above ambient values for some heavy metals, organic compounds, and pathogens (Battelle, 1990). Dumping of dredge material on the shelf is expected to continue during the next 30 years, as permitted by the Corps of Engineers and at sites designated by the USEPA. Dredge spoil sites are expected to affect local water quality for short periods of time (a few days) by temporarily increasing turbidity. Other inner shelf and OCS activities during the next 30 years including gravel, sand, phosphate, and manganese mining are expected to produce water pollution in the form of added turbidity.

Impacts on onshore water quality that are expected to increase during the next 30 years are from dredging, agricultural run-off, municipal waste disposal, storm sewer overflow, and saltwater intrusion. Maintenance dredging in harbors affect water quality by increasing turbidity. Saltwater intrusion into aquifers in south Florida is caused by the excessive diversion of freshwater for urban and agricultural uses. Ultimately, the decrease in fresh water recharge of aquifers and streams increases the salinity of inshore waters.

Accidental discharges of oil including both small, operational spills and oil spills 1,000 bbl or greater from tankers carrying imported oil are expected to have an important effect on water quality. Since most small oil spills are expected to consist of fuel oil and are therefore highly volatile, small oil spills are expected to affect water quality for relatively short time periods (a few hours to days) depending on size of spill, volume of estuary, and tidal exchange. However, because of the high toxicity of fuel oil spills they are expected to have a major, although short-term (few days), effect on water quality. Factors such as turbulence and the amount and type of suspended sediment, can extend the impact of fuel oil spills on water quality from days to months.

The effect of oil spills 1,000 bbl or greater on water quality is discussed in Section IV.D.1.b(1)). These effects will depend on the amount of volatile components in the crude oil and the extent to which the volatiles are retained in the water column. The more toxic and volatile components in crude oil spills are expected to evaporate rapidly. The remaining, high viscosity components have relatively little effect on chemical properties of water, the principal effect is the physical fouling of marine organisms and habitats. Spills in the offshore environment are expected to disperse rapidly due to prevailing currents and turbulence so that effects on water quality are expected to be limited to a few days.

The most severe effects on water quality would occur if the spill was inshore. As described in the base-case scenario (Section IV.D.1.a(1), oil spills in the south Atlantic are more likely to reach coastal or inshore waters than spills in the mid-Atlantic. The effects of inshore oil spills on water quality are discussed in Section IV.D.1.b(1) where it was concluded that the impact on water quality may last from months to years, depending on the extent to which the crude oil is entrained in bottom sediment.

The effects of routine OCS development during the next 30 years in the mid- and south Atlantic are not expected to measurably affect onshore or offshore water quality. The most severe effects on water quality are expected to be limited to the immediate vicinity of the discharge site and are expected to persist for not more than a few hours. However, during the same time period, the impacts on water quality associated with population growth along the Atlantic coast are expected to exceed the impacts from OCS activities. Also, during the next 30 years, water quality along the Atlantic coast is expected to be affected considerably by oil spills from tankers carrying imported oil and oil products. The most important effects on water quality are expected from inshore oil spills.

CONCLUSION: Water pollution from routine OCS gas and oil activities under the cumulative scenario is not expected to measurably degrade water quality onshore or offshore. Some water quality parameters including, turbidity and hydrocarbons, are expected to be elevated one or two orders of magnitude for a few days or less.

(2) Impacts on Air Quality

(a) Gulf of Mexico Region

The cumulative analysis considers the impacts from the following factors and/or activities: power generation, industrial activities, and transport in the Gulf of Mexico, the proposed action, past and future OCS sales.

Ozone is of great concern because its environmental effects. In the northcentral Gulf six parishes are nonattainment for this pollutant. Ozone measurements (LADEQ, 1990a) between 1989 and 1990 from Morgan City in St. Martin Parish, Thibodaux in Lafourche Parish, and Westlake in Calcasieu Parish were examined. These measurements show that in Morgan City and Thibodaux, ozone concentration never exceed the national standard. Concentrations were between 15 and 25 ug/m^3 below the standard during episodes of highest ozone concentrations. At other times concentrations were 45 to 50 units below the national standard. At Westlake in Calcasieu Parish, which is north of Cameron Parish, the ozone concentrations exceed the national standards at least twice during 1989 and once during the first 8 months of 1990. Since Cameron parish, the coastal parish, is attainment for all pollutants an argument could be made that OCS emissions are not the cause of Calcasieu ozone problems. The number of ozone violations in Texas during 1989 (TACB, 1989) along coastal regions were none in the southern regions of the state, between 0 and 7 in Beaumont and Pt. Arthur area, and the between 5 and 14 in Region 7 which is comprised mostly of the Houston area. In Florida only 3 coastal counties have ozone problems. At present, the MMS has no way to assess the probable impacts to the ozone nonattainment or attainment status because (1) ozone is not emitted and (2) the MMS has no modeling capacity to calculated how much ozone it produces from its emissions.

The amount of power generation is very difficult to predict, because it depends on many unquantifiable factors. Therefore, different sets of assumptions result in different estimates. The envelope of predictions shows that energy consumption should increase up to the year 2010, after this predictions show more variation, but generally indicate an increase of energy consumption. Because energy production is the largest single pollutant generator, it is safe to assume that emissions must also increase (USDOE, 1990c, d). However, advances in control technology and use of alternative energy sources can change the correlation between energy production and emissions. The available information (USDOE, 1990c, d) indicates that SO_x emissions from energy generation decreased 16.4 percent between 1970 and 1987. Pollutants whose emissions increase over the same period are CO and VOC. Other pollutants that showed a decrease over the 1970-87 period are particulate matter and NO_x. The overall amount of pollutants emitted decrease over this period.

Emissions of the primary pollutants related to industrial activities showed a decrease over the 1970-87 period. The reduction in the total amount of pollutants was 51 percent (Godish, 1991). Section III.C.2 indicates that employment will increase. Such increase in employment can be interpreted as an increased of industrial activities. However, assuming that the decreasing trend of emissions holds during the next 35-years, its safe then to assumed that emissions related to industry would not increase or at worst would remain at the present levels. Then the impacts to the air quality from industrial would remain at the present levels or, better, they may decrease.

Transportation related emissions are an important consideration in regard to inshore air quality, since vehicles constitute the second largest emitters of SO_2 and NO_x and the largest source of carbon monoxide (USDOE, 1990c, d). Emissions of particulate matter and SO_x increased, while NO_x emissions remained the same over the 1970-87 period. Emissions from CO and hydrocarbons decrease over the same period. The overall emissions showed a reduction of almost 44 percent during the 1970-87 period (Godish, 1991). Vehicular use is population-dependent, and the demographic trends through most of the 80's have been towards a decrease in population in most states bordering the Gulf of Mexico. A recent projection for the MMS (Section III.A.3) indicates that this trend will be reversed, and population will increase. Thus, vehicular use will increase, but advances in fuel efficiency, alternative gasoline developments, and better emission controls will probably cause a decrease of emissions or, at worse, remain at the same level. Thus, vehicular emissions will not increase present impact levels; even better, levels may decrease.

The scenario for the cumulative program-related activities establishes that 12,050 exploration and delineation wells and 7,780 development wells would be drilled(see Table IV.D.1.c-2). This scenario also calls for the construction of 518 platforms each with a 20-years life after which they are removed. Vessel trips that would take place in the OCS Program activities are estimated at 592,500. The information presented below shows total emissions from wells, platforms, and vessels in the Gulf from cumulative program activities. NO_x still is the most emitted pollutant while SO_x is the least emitted. This information shows that wells contribute mostly NO_x, platforms contribute mostly NO_x, CO, and VOC, while vessels are contributors of all pollutants.

Total emissions for each planning area in the Gulf of Mexico for the cumulative program-related activities scenario are presented below. Estimated emissions are greatest offshore north-central Gulf and Texas reflecting greatest development while offshore Florida, which is expected to have the least development, emits the least (Table IV.D.1.c-8).

Table IV.D.1.c-8. Total Emissions for the Gulf of Mexico Region (in 1,000 metric tons)

Pollutant	Offshore Texas	Offshore Louisiana	Offshore Florida
NO_x	858.8	6,060.9	49.4
CO	139.1	854.4	9.4
SO_x	34.0	95.9	3.8
VOC	299.8	2,283.2	16.8
PM_{10}	39.4	120.5	4.4

The pollutant emissions are not uniform. During the early years of the proposed activities emissions would be largest and decrease over time as reserves and production decreases. After reaching a maximum, emissions decrease rapidly to zero as this scenario assumes most platforms and wells will be removed and service vessels trips no longer needed. The information below presents the emissions in metric tons per year for the primary pollutants during the proposed activities. However, it is assumed that service vessel and combined well and platform peak emissions occur simultaneously. In this analysis the aggregate peak emissions which are two to three times the average rates will be employed.

The mean or average emission per year for the Gulf of Mexico and the vessels were computed by dividing the total emissions by the 45-year program life (Table IV.D.1.c-9).

The MMS studied the impacts of offshore emissions using the Offshore and Coastal Dispersion (OCD) Model (USDOI, MMS, 1986). The study was conducted off the east central coastline of Louisiana. A total of 8 offshore areas containing from 19 to 85 production complexes and from 19 to 195 point sources were include in the study. Distance from the coastline range from 5.6 km to 45 km

Table IV.D.1.c-9. Gulf of Mexico Mean and Emission Rates (in 1,000 Metric Tons)

Pollutant	Mean	Well	Platform	Vessel	Aggregate
NO_x	154.9	13.92	74.2	1.9	290.0
CO	22.3	3.7	35.7	1.6	41.1
SO_x	3.0	1.7	0.5	2.1	4.2
VOC	57.8	0.4	103.9	1.6	105.9
PM_{10}	3.6	1.4	0.7	2.8	4.8

(3.5 to 28 mi). The mixing height used on these runs was 300 m, which represents the lower bound of the observations near Panama City (Hsu, 1979). Because the last model run in the study represents an aggregation of all sources and covers the entire distance range this discussion will emphasized those results. The highest one-hour NOx concentration observed was 71.89 ug/m^3, the annual arithmetic mean at several onshore stations had annual means which vary between 1.83 and 0.82 ug/m^3 which are below the national standards of 100 ug/m^3. All other inert pollutants will have lower concentrations. The concentrations calculated from the high case are ten to one twenty-six times smaller than the results from the model. This modeling effort represents the combined effect of 85 production complexes close to onshore areas. The concentrations derived from emissions associated with the high case, 360 platforms spread over 563.7 billion m^2 would have a much smaller effect. Distributing all emissions over a volume obtained by using a mixing height of 300 and 900 m, the hourly concentrations during peak year emissions are .20 and .07 ug/m^3 respectively. Another modeling effort off Texas (USDOI, MMS, 1990) shows that concentrations reaching the onshore areas would be between .06 and .19 ug/m^3.

Suspended particulate matter, which is produced by the same sources that produced the emissions, is important because of its potential in degrading the visibility in national wildlife refuges or parks designated as PSD Class I areas. The impact depends on emission rates and particle size. Particles larger than 10 microns settle very close by to the source, so the concentrations reaching these areas would not be large. For particles smaller than 10 microns which do not settle fast, concentrations would be greater, but because their emissions are smaller their concentrations would be smaller. Because the onshore average wind speeds are very low (between 1-3 ms^{-1}) the time of travel to these areas will be long enough to allow deposition before reaching these areas. Removal of these suspended particulate by rains would be high because the large amounts of rains in the area.

It is assumed that oil spills in the category greater than and equal to 1 bbl and less than 50 bbl, as well as greater than 50 bbl and less than 1,000 bbl, would not cause an air quality classification because their input of pollutants (it is assumed that 75 percent of the spill would evaporates in three days) would be less than the national standards allowable emissions. Information (USDOI, MMS Tech. Paper No. 83-8, 1984) of emissions from OCS accidents indicates emissions of less than 100 tons/hour by the second hour. For spills greater than or equal to 1,000 bbl, emissions are of order 285 tons/hour or smaller. Also, the ten spills (1,000+bbl) assumed to occur Gulfwide are uniformly distributed over the Gulf area, so that their pollutant concentrations will be dispersed well by the winds and turbulence. Concentrations reaching onshore areas from these spills would be on the same level as before based on the dispersion, limited input of pollutants to the atmosphere, and transport regime present. The emissions from the oil spills will last until all the volatile compounds are evaporated, and this takes about three days. Although the number of spills from program-related activities is large (for example 10 large OCS-related oil spills and other spills, related to import tankering and transportation of petroleum products) these occur randomly in space and time so the emissions are isolated and rapidly dispersed. Also, these emissions are insignificant when compared to the emissions from activities such as exploratory and development drilling, platform emplacement, and vessel operation.

About four percent of OCS crude-oil production is offloaded from surface vessels at ports off Texas and the northern coast of the Gulf. Off Florida, up to 25 percent of the OCS production would be offloaded from surface vessels. The unintentional emissions from these offloading operations are estimated to be 17,260 metric tons or about 1 percent of the VOC emissions in the Gulf of Mexico. Safeguards to ensure minimum emissions from the offloading and loading operations have been adopted by the State of Louisiana (The Marine Vapor Recovery Act, 1989: LAC: III.2108). Offloading off Texas has the same magnitude as in the northern Gulf coast, therefore, it is reasonable to assume the same impacts to onshore air quality. Off Florida, offloading percentage will be greater but the small amount of oil projected to be produced coupled with the local meteorology (unstable atmosphere and offshore winds) leads us to expect that concentrations reaching the onshore will not cause a reclassification of air quality status. Current industry practice is to extend pipelines to new production facilities when feasible; barging, then, would be needed only during the construction phase. Emissions from towboats in these operations are expected to produce negligible effects on air quality.

In summary, emissions of the primary pollutants related to industrial activities showed a decrease over the 1970-87 period. The reduction in the total amount of pollutants was 51 percent (Godish, 1991). Vehicles constitute the second largest emitters of SO_2 and NO_x and the largest source of carbon monoxide (USDOE, 1990). The overall emissions showed a reduction of almost 44 percent during the 1970-87 period (Godish, 1991).

Emissions from OCS sources are estimated to be greatest offshore the north-central Gulf and Texas reflecting greatest development while offshore Florida, which is expected to have the least development, emits the least. Total emissions estimated from proposed new wells, platforms, and vessels in the Gulf indicates that wells will contribute mostly NO_x, platforms mostly NO_x, CO, and VOC, and vessels will contribute all pollutants. During the early years of the proposed action, emissions would be small and increase over time as production increases. After reaching a maximum, emissions will decrease rapidly to zero as the base-case scenario assumes all platforms and wells will be removed and service vessels trips no longer needed. Ozone is of great concern because its environmental effects. At present, the MMS has no way to assess the probable impacts to the ozone nonattainment or attainment status because (1) ozone is not emitted and (2) the MMS has no modeling capacity to calculated how much ozone it produces from its emissions.

For spills greater than or equal to 1,000 bbl, emissions are of order 285 tons/hour or smaller. Concentrations reaching onshore areas from these spills would be on the same level as before based on the dispersion, limited input of pollutants to the atmosphere, and transport regime present. The emissions from the oil spills will last until all the volatile compounds are evaporated, and this takes about three days. About four percent of OCS crude-oil production is offloaded from surface vessels at ports off Texas and the northern coast of the Gulf. Off Florida up to 25 percent of the OCS production would be offloaded from surface vessels. The unintentional emissions from these offloading operations are unknown, but are estimated to be negligible (von Bodungen pers. comm., 1988) in the northern coast of the Gulf.

CONCLUSION: Overall cumulative impacts, which include the effects of non-OCS related factors (industrial and vehicular emissions, power generation, etc.) and OCS activities will degrade onshore air quality to some extent. Despite this, emissions of primary pollutants from industrial activities will continue to decline or at worst stabilize over the life of the proposal, based on recent/historical trends. Emissions of pollutants into the atmosphere associated with the program-related activities are likely to have concentrations that would not change onshore air quality classifications because of the prevailing atmospheric conditions and emissions height. Onshore concentrations of air pollutants from program-related emissions are estimated to be near 1 ug/m^3 (annual average) because the atmospheric regime, the emissions, and distance of these emissions from the coastline. Based on the above reasons and propositions, the air quality status in the Gulf of Mexico will not change because of the emissions from proposed activities.

(b) Alaska Region

Impact-producing agents that have the potential to affect onshore air quality include onshore and offshore routine and accidental emissions. Onshore routine emissions that may occur concurrent with and interact with OCS emissions include TSP from potential Chukchi coastal coal mining and Prudhoe Bay oil and gas facilities. Offshore routine emissions that may occur concurrent with and interact with OCS emissions include dredging offshore Nome for gold and the Endicott, and Northstar Prospects in the Beaufort Sea near Prudhoe Bay.

Oil spills are the only accidental activities likely to affect air quality. Accidental emissions result from gas blowouts, evaporation of spilled oil, and burning of spilled oil.

The Prudhoe Bay/Kuparuk oil-production complex and the refinery in Kenai are major sources of pollutants in their respective areas. Concentrations of NO_x (likely the largest pollutant) onshore could be high within a few kilometers of a source. However, existing air-quality-monitoring analysis shows compliance with the State's standard for NO_x of 100 ug/m^3. Oil production at the Prudhoe Bay/Kuparuk complex is forecast to continue a decline in production with ongoing emphasis to develop smaller peripheral fields. As production increases farther from the present main production complex, dispersion of pollutants will lower concentrations of pollutants in the ambient air. The USDOI, MMS (1990c) Sale 124 cumulative-case considered potential annual production of 76 MMbbl from each of seven platforms (1) clustered at the 3-mile limit and (2) from platforms widely dispersed across the Beaufort Sea. Onshore concentrations of NO_x were modeled because NO_x was estimated to be the largest pollutant. Modeling of the clustered case showed onshore concentrations of 16 ug/m^3 NO_x. However, where onshore concentrations are that high, controls on emissions would be required. In addition, it was not expected that production activities would be located adjacent to each other close to shore. The Sale 124 case, where production platforms are widely dispersed across the Beaufort Sea, results in NO_x below 0.5 ug/m^3 at the shoreline. Concentrations of other pollutants would be much lower than for NO_x. Further, because continued dispersion would reduce concentrations of pollutants with distance, only a small area at the shoreline (a few square kilometers) would be affected.

Production from Endicott also may occur concurrent with OCS production. Estimated combined production from the two prospects would be about the same as one platform from the USDOI, MMS (1990c) Sale 124 cumulative case. Emission controls would be required on sources from these two prospects.

Increases in NO_x concentrations in the ambient air due to the proposal may occur as high as 0.91 ug/m^3 from exploration and 0.05 to 0.11 ug/m^3 from production. Concentrations are at the shoreline. Dispersion would reduce concentrations with distance from the source. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions) starting in year 10. Production is expected to occur from years 12 to 30 after a lease sale, with the highest level of production occurring during the first year of development.

Chukchi coastal coal mining could raise the onshore ambient concentration of TSP over a few hundred square kilometers. Concentrations of most background pollutants along the Chukchi coast presently are about the same as at the Red Dog Mine in the western Brooks Range. Ambient concentrations are at or less than the level detectable by air-quality-monitoring instruments. No mining of Chukchi coastal coal is presently planned.

The above estimates are based on estimates of uncontrolled emissions. Controls would be required as appropriate for all activities emitting more that 250 tons per year of regulated pollutants.

The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last a short period after emissions cease. Soot from burning of spilled oil would affect a small area. The size, number, and occurrence of accidental emissions is unknown. While such events do occur, the level of occurrence is low and, once the event is over, air quality returns to normal relatively quickly. Concentrations of pollutants are quickly (less than a month) dispersed in the atmosphere returning air quality to prior levels.

In summary, increases in concentrations of onshore pollutants may occur as a result of onshore and offshore projects. Increases would be over small areas for NO_x and SO_2 (tens of kilometers) and a large area for TSP (hundreds of kilometers). Increases would be small for NO_x (1 ug/m^3 but possibly up to 16 ug/m^3). Concentrations of SO_2 would be as much as 0.82 ug/m^3 (annual) and 67.44 ug/m^3 (3-hour). Increases in TSP concentrations are unknown. The increase in TSP concentrations would be due to any Chukchi coastal coal development. Other increases would be due to offshore sources, primarily OCS sources. The NO_x concentrations due to onshore sources are expected to decrease over the life of the proposal due to the decline of the Prudhoe Bay field and production occurring away from the production complex allowing for dispersion of pollutants. Such increases would occur over the lifetime of operations and return to prior levels quickly after the end of operations.

The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from OCS accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last a short period after emissions cease.

CONCLUSION: Routine activities and accidental emissions are the major contributions to impacts on air quality (platform emissions of NO_x, blowouts, and burning of spilled oil for SO_2 and VOC). Under the cumulative scenario, increases in NO_x concentrations of up to 1 ug/m^3 (possibly up to 16 ug/m^3 where all expected development occurs in a very small area) may occur due to the proposal or other sources. Increases in concentrations of SO_2 of 0.82 and 67.44 ug/m^3 (annual and 3 hour, respectively) are expected. Increases in concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. Ambient air quality would meet State and Federal standards. Such increases would occur over the lifetime of operations and return to ambient levels quickly after the end of operations. Based on the proposal scenario assumptions, the base case is expected to cause NO_x concentration increases to the ambient air of 0.3 to 0.7 ug/m^3 over less than 1 percent of the Alaskan shoreline during exploration, and 0.01 to 0.17 ug/m^3 during production. Increased concentrations of SO_2 and VOC from the oil spills of the proposal are expected to be less than from normal operations and last for a short period (30 days or less).

(c) Pacific Region

Major sources of air emissions in the Pacific Region include transportation, electrical power generation, agricultural activities, oil and gas production, refining operations, and manufacturing. In southern California, the most significant of these sources is automobile exhaust.

Projected total NO_x emissions for Ventura, Santa Barbara, and San Luis Obispo Counties are about 16,000, 11,000, and 9,000 tons per year, respectively. Projected total RHC emissions for those same counties are 24,000, 14,000, 8,000 tons per year, respectively.

There are two sets of impact estimates available for the cumulative case. One is the 1989 Jacobs Engineering report “Air Quality Impact of Proposed Lease Sale 95, Final Report” (Jacobs 1989) and the second is “Final Santa Barbara County 1989 Air Quality Attainment Plan” by the Santa Barbara Air Pollution Control District (SBAPCD) (1990). These two documents provide estimates of the air quality impacts of offshore petroleum activity in the year 2000 (for the SBAPCD) and 2001 (for Jacobs).

For their estimates, Jacobs conferred with MMS to determine the expected production rate trends for all seventeen existing production platforms offshore of Santa Barbara and Ventura Counties. It was determined that only ten of the seventeen were likely to be in operation by the year 2001. The combined emission rates for these ten platforms projected to the year 2001 are the first entry in Table IV.D.1.c-10a. The next estimate by Jacobs was for 6 planned platforms that had already been permitted or were in the process of being permitted. Their estimated combined annual emissions are listed in line two of Table IV.D.1.c-10a.

Line 3 of Table IV.D.c-10a shows the estimated emissions for eleven hypothetical generic platforms. Four of these represent, planned platforms and 7 represent assumed platforms. This brings the total to 27 platforms projected for the year 2001. The total annual projected emissions in the year 2001 from all 27 platforms are listed on the last line.

The SBAPCD used a different approach in estimating the emissions of NO_x and reactive hydrocarbons. They assumed that all seventeen platforms that currently exist off of Santa Barbara and Ventura Counties will be in production in the year 2000. They added to these, the emissions from 3 proposed platforms and 7 hypothetical platforms for a total of 27 platforms projected for the year 2000. The total projected annual emissions of ROG and NO_x for these 27 platforms are listed as the first line of Table IV.D.c-10b. It should be noted that the values are over twice as large as the corresponding values arrived at by Jacobs.

Table IV.D.1.c-10a. Estimated Emissions for the Year 2001 – Jacobs (1989)

	RHC[3]	NO_x 3	SO_2[3]	CO[3]	PM_{10}[3]
10 existing platforms[1]	649.1	450.3	54.6	134.3	35.4
6 planned platforms[1]	105.2	240.3	77.8	74.3	23.0
11 potential platforms[1,2]	213.0	674.5	147.1	384.3	67.9
Total					
27 platforms	967.3	1345.1	279.5	592.9	126.3

1. Based on estimates prepared by Jacobs (1989).
2. Potential platforms — 4 hypothetical; and 7 proposed.
3. Tons per year.

Table IV.D.1.c-10b. Estimated Emissions for the Year 2000 – Santa Barbara APCD

	ROG	NO_x
27 existing, planned or hypothetical platforms	2377	3045
natural oil & gas seeps	605	—
channel shipping	987	6231
onshore south county	7001	5290
state tidelands	5920	5633
commercial/recreational boats	155	74
Total all sources	17,045	20,273

No new onshore processing facilities are expected to be constructed to accommodate hydrocarbons produced from blocks included on the proposed leasing schedule. Existing or currently planned facilities will be modified as necessary to treat newly discovered and gas resources. Consequently, these onshore processing facilities will continue to produce emissions throughout the project life of the proposed leasing schedule. Acceptable emission levels for onshore facilities have been established and are enforced by local air quality management agencies. These facilities are expected to continue to comply with local air quality regulations.

The two lines that follow the SBAPCD projections of total annual emissions list the projected emissions emanating from natural oil and gas seeps and shipping in the Santa Barbara Channel. The last line contains the total projected annual emissions from south Santa Barbara County, State Tidelands and the OCS combined.

According to SBAPCD's values, channel shipping alone is projected to produce over twice the NO_x produced by all 27 OCS platforms combined.

Using SBAPCD's calculations, OCS oil and gas activity are expected to contribute only 10.7 percent of all ROG and 17.7 percent of all NO_x emitted in or offshore of Santa Barbara County by the year 2000.

As a result of the new USEPA air quality regulations for the OCS, facility operators would be required to obtain emission offsets for all emissions of NO_x and RHC from a facility, including emissions from vessels in transit when within 25 miles of the facility. Platforms located off Santa Barbara and Ventura Counties would need to acquire offsets at a ratio of 1.2 to 1, and platforms located off San Luis Obispo County would have to obtain offsets at a 1:1 ratio. Emissions due to vessel activities would be dispersed along the vessel route from port to a platform. Onshore concentrations from vessel emissions would be small, and impacts on ozone are expected to be negligible.

The SBAPCD applied the Urban Airshed Model (Airshed) photochemical computer simulation model to their emission inventories for the region. In a run using data from 1984, the model predicted 15.3 pphm O_3 at Santa Barbara City when the observed value was 15 pphm (2% high) and 14.2 pphm at Goleta when the observed peak was 16 pphm (11% low). The model was then applied to their estimated emissions for the year 2000 both with and without the OCS emissions to ascertain the contribution of the OCS emissions to O_3 formation. The Goleta calculations showed a 12.3 pphm without OCS emissions and 12.5 pphm with OCS emissions. The Santa Barbara City simulation resulted in 13.7 pphm when OCS emissions were included and 13.0 pphm when they were not. The increase in ozone amounted to 1.6 percent at Goleta and 5.1 percent at Santa Barbara.

CONCLUSION: Onshore emission sources will continue to be the primary source of air pollutants in the Pacific Region. The OCS contribution to onshore ozone formation is small. Emissions of NO_x and RHC from platforms and vessels are estimated to be less than 5 percent of future projected onshore emissions. However, the status of the onshore counties as non-attainment for ozone and implementation of the new Clean Air Act are likely to result in a requirement for total offsets of all RHC and NO_x emissions produced. The result will be no net increase in the levels of air pollution emissions over the 30-year period of the proposal.

(d) Atlantic Region

Air quality impacts resulting from routine OCS activities were described in the proposal (see Section IV.D.1.a(2)), where it was concluded that onshore air quality will not be affected by routine OCS activities. Offshore air quality will only be affected in the immediate vicinity of the emissions and only during the time period of the emissions. Under the cumulative scenario, which is described in this section, air quality impacts for the entire Atlantic coast resulting from OCS and non-OCS development over the next 30 years will be evaluated. The impacts on air quality caused by oil spills from tankers carrying imported petroleum and petroleum products are included in this analysis.

The base case lists potential causes of air quality impacts due to routine OCS activities (Section IV.D.1.a(2)). Causes include combustion of diesel fuel by support vessels and drilling ships, and the combustion of natural gas on OCS drilling platforms during offshore development and production. Pollutants released during these activities include NO_x, SO_x, CO, and TSP. H_2S may also be released during well testing and gas processing. An increase in total pollutant emissions above those from offshore activities is expected to occur under the cumulative-case scenario as a consequence of the 45 percent increase in the total number of wells drilled. In addition, an increase in onshore pollutant emissions will occur due to an increase in the number of gas processing plants from 2 to 3.

Under the cumulative scenario, potential sources of onshore air pollution during the next 30 years are expected to increase as a result of population growth. Potential causes include power generation, waste incineration, petrochemical production, refining of petroleum, and fuel combustion. Included in these emissions are CO, NOx, SOx, HC, and particulates. The actual rate of increase in these emissions will depend on energy conservation measures, future enforcement of emission regulations required under the CAA (see Section III.D.1), and State and local government air quality regulations.

Additional sources of air pollution include accidental oil spills. The number, size, and location of oil spills have been discussed previously.

The potential impacts on air quality from routine offshore and onshore emissions are discussed in Section IV.D.1.b(2). Routine offshore OCS activities will affect air quality in the immediate vicinity of the source but will dissipate immediately after emissions cease due to prevailing offshore winds. Onshore air quality is not expected to be affected by anticipated activities at either offshore or onshore support bases under the proposed action. Additional offshore air pollution will occur as a result of an increase in the number of wells drilled and platforms occupied. However, emissions generated offshore are not expected to affect onshore air quality for the following reasons: (1) emissions are expected to be greatly dispersed by the time they reach shore; 2) prevailing coastal winds are offshore (see Section III.D.1); 3) the increase in exploration and development is expected to be distributed over a longer time period than in the proposed action; and 4) stricter controls on offshore pollutant emissions are anticipated.

As a consequence of 1991 amendments to the CAA, it is anticipated that Atlantic coastal States will take an active role in regulating air pollution emissions on the OCS. Regulation of pollutant emissions on the OCS within 41 km of the coast (except the Gulf of Mexico) will be the same as onshore regulations. Guidelines for regulating emissions on the OCS beyond the 41 km distance will be determined by the USEPA. The 1991 amendments are likely to result in more stringent controls on OCS pollutant emissions during the next 30 years.

Onshore air pollution above levels described for the proposed action is expected to result from: (1) additional gas processing; (2) pipeline laying; and (3) the longer duration (30 years) of OCS activities in this scenario. The additional gas processing plant may result in an increase in volatile hydrocarbons, H_2S, and SO_x emissions onshore. However, pollution control equipment will be required in the gas processing plant to comply with NAAQS and State air quality standards. Potential air pollutants, including H_2S, may also be released during dredging operations required for laying gas pipelines, as described in Section IV.D.1.b(2).

It is expected that the major population, industrial, and commercial centers on the Atlantic coast (including Boston, New York, Baltimore-Washington, and Charleston) which are now NAAQS nonattainment areas for various air quality parameters (see Section III.D.1), will continue to serve as the principal sources of air pollution on the Atlantic coast over the next 30 years. Additional, activities on the shelf over the next 30 years, including channel dredging, sand and gravel mining in State waters and offshore, and phosphate mining in the south Atlantic, are expected to result in added air pollution. These additional activities are not expected to seriously affect onshore or offshore air quality. More stringent emission standards under the CAA and State air quality regulations, energy conservation, alternative energy sources, and improved waste disposal technology are factors that will reduce the impact on air quality.

The impact on air quality from small operational oil spills is described in Section IV.D.1.a(2). The impact on air quality from small oil spills is expected to be limited to the time period during and immediately after the spill. For spills occurring on the OCS, the prevailing offshore winds are expected to result in rapid dissipation and no effect on onshore air quality is anticipated. Air quality is expected to be diminished by inshore oil spills, but due to the fact that small oil spills are expected to be diesel fuel spills, these spills will dissipate within a few hours or days.

In this scenario, oil spills greater than or equal to 1,000 bbl are projected to occur both offshore and inshore. The impact of an oil spill of this magnitude on air quality was described in Section IV.D.1.a(2), where it was concluded that these spills are expected to have an immediate effect on air quality. The more toxic and volatile components will dissipate rapidly resulting in immediate air quality degradation. The duration of degraded air quality will vary with respect to prevailing winds. Generally, the effects on air quality are expected to last up to 3 days because the most volatile components, usually about 50 percent of the spill, will have dissipated within a few days (NRC, 1985a). Due to prevailing winds, spills offshore are not expected to affect onshore air quality. Oil spills inshore, however, are expected to have an immediate effect on onshore air quality. As a consequence of restricted inshore water circulation, oil spill dissipation will slow down, promoting an extended period of poor air quality. The effect on air quality from an inshore oil spill is expected to last from days to several years, depending on the amount of oil trapped in sediment. The most likely location for inshore oil spills are Delaware and Raritan bays, where 70 and 15 percent, respectively, of the refinery capacities on the Atlantic coast are located.

The effects of routine OCS development during the next 30 years in the mid- and south Atlantic are not expected to seriously affect onshore or offshore air quality. However, during this same period, the impacts on air quality associated with population growth along the Atlantic coast are expected to exceed the impacts from OCS activities. Over the next 30 years, air quality along the Atlantic coast is also to be affected by oil spills from tankers carrying imported oil.

CONCLUSION: Air pollution emissions from OCS gas and oil development under the cumulative scenario especially those associated with increasing population densities degrade air quality onshore or offshore. Other sources of air quality degradation are expected to have a greater impact on air quality.

(3) Impacts on Marine Mammals

(a) Gulf of Mexico Region

1) Threatened or Endangered Species

This cumulative analysis considers the present status of populations and migratory habits of threatened and endangered marine mammals, and the effects of impact-producing factors related to commercial fishing; pathogens that may occur and adversely affect sperm, fin, and sei whales; recreational whale watching; crude oil imports by tanker; and the proposed action, prior, and future OCS sales. These impact-producing factors are discussed in detail in Section IV.D.1.c.

It is assumed that the migratory behavior of endangered fin and great sperm whales expose them to potential adverse impacts generated from all Gulf of Mexico and Atlantic OCS planning areas, as well as routine and accidental events originating from Central America, North America, Europe, and the Caribbean. Both mortalities and sublethal effects on migrating fin and great sperm whales are expected from this multitude of activities. The incremental contribution of each adverse influence on fin and great sperm whales cannot be determined; however, the effects from such a potentially large number of adverse sources would cause the partial loss of populations or species of fin and/or great sperm whales within the Gulf of Mexico Region. Should the adverse effects cease, the affected populations or species would stabilize (not increase) within two to three generations.

Commercial fishing equipment entangles and drowns threatened and endangered marine mammals during routine activities or during accidental "ghost" fishing by lost or discarded gear (Tucker and Associates, Inc., 1990). Although the extent of incidental take and death during "ghost" fishing is largely undocumented, it has been noted as an activity of concern by the NMFS and the Marine

Mammal Commission. It is expected that both routine commercial and accidental "ghost" fishing will cause fewer than five mortalities of threatened and endangered marine mammals per year, resulting in a partial loss of a local population. Should the adverse affects from commercial and "ghost" fishing cease, the affected population would recover within one to two generations.

Epidemic die-offs or mass strandings occur in several species of threatened and endangered marine mammals. The causes are difficult to diagnose as has been the case with abnormal cetacean mortality in the Gulf in 1989-1990 and along the Atlantic Seaboard in 1988 (USDOC, NMFS, 1990b). Numerous strandings of great sperm whales have been reported in the Gulf for each month. Naturally occurring and anthropogenic toxins have been the hypothesized cause. Sources include algal blooms, oil spills, ocean dumping, industrial/municipal effluents, and agricultural runoff. These concentrations are not widespread and mortalities occur in localized areas but affect regional populations. It is expected that the effects of toxins on threatened and endangered marine mammals will cause a partial loss of a regional population. Should the adverse affects from contact with toxins cease, the affected population would recover within two to three generations.

Recreational whale-watching is an applicable impact-producing factor to only large threatened and endangered marine mammals. Although whale-watching vessels may displace or collide with whales, no incidents of this nature have been reported. These activities are not popular in the Gulf; however, it is assumed that they regularly occur on the eastern seaboard and affect fin and great sperm whales during annual migration to the Gulf of Mexico. It is expected that these activities cause sublethal effects that elicit a startle reaction from or mask the sound reception of fin and great sperm whales. It is expected that the effects of recreational whale-watching on threatened and endangered marine mammals will delay fewer than five fin and/or great sperm whales during annual migration to the Gulf of Mexico, resulting in a few losses of a localized population. Should the adverse affects from recreational whale-watching cease, the affected populations or species would recover within one generation.

Produced waters, drilling muds and drill cuttings discharges can potentially impact threatened and endangered marine mammals by displacing or reducing their food sources. These effluents are routinely discharged into offshore marine waters and regulated by USEPA's NPDES permits. An estimated 113.53 million bbl of drilling muds, 33.44 million bbl of drill cuttings, and 12.56 billion bbl of produced waters are assumed to be discharged offshore as a result of the proposed OCS exploration and production activities, Gulfwide. Offshore operational discharges are not lethal to threatened and endangered marine mammals and are diluted and dispersed rapidly to the extent that adverse effects to marine mammal food sources do not occur (API, 1989; NAS, 1983). The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a threatened and endangered marine mammal to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (several minutes) spent traversing the plume.

Noise from helicopter and service-vessel traffic may elicit a startle reaction from threatened and endangered marine mammals or mask their sound reception. This effect is sublethal and at worst of a temporary nature lasting less than an hour (Gales, 1982). Dolphins and pilot whales actively seek out and accompany service vessels for some distance with no adverse effects. Service vessels could collide with and directly impact threatened and endangered marine mammals, but due to maneuverability and echo-location, encounters of this type are extremely rare (Slijper, 1979; Kraus, per. comm., 1987).

An estimated 200,000 helicopter trips will be flown annually in support of the proposed action, prior, and future OCS sales. It is assumed that helicopter traffic will occur on a regular basis. The MMS prohibits the use of fixed-wing aircraft lower than an elevation of about 150 m and helicopters lower than about 300 m. It is estimated that at these elevations threatened and endangered marine mammals would not be startled by OCS helicopter traffic. It is expected that helicopter traffic will not affect threatened and endangered marine mammals because of special prohibitions and adherence to the general FAA recommended minimum ceiling of 300 m.

Service vessels comprise the greatest amount of marine traffic associated OCS activities. Noise from service-vessel traffic may elicit a startle reaction from or mask the sound reception of threatened and endangered marine mammals within 15 m of the vessel. It is estimated that approximately 12,000 service-vessel trips per year will be completed in support of the proposed action, prior and future OCS sales. This represents less than five percent of the total annual vessel traffic in the Gulf of Mexico. In addition, threatened and endangered marine mammals can avoid service vessels and operators can avoid marine mammals. This startling effect is sublethal and at worst of a temporary nature lasting less than an hour. The effects on threatened and endangered marine mammals from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour.

Exploration, delineation and production structures produce sounds at intensities and frequencies that can cause sublethal effects by inhibition of the ability of a threatened and endangered marine mammal to acoustically locate its prey. However, the decibel levels of these sounds dissipate to the tolerance of most threatened and endangered marine mammals within 15 m of the sound source. It is estimated that about 268 exploration and delineation wells and about 172 development wells will be drilled annually and produce sounds at intensities and frequencies that could be heard by cetaceans. It is estimated that noise from drilling activities will last no longer than five months at each location. However, the decibel level of these sounds dissipates to the tolerance of most threatened and endangered marine mammals within 15 m of the source. The effects on threatened and endangered marine mammals from platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour.

Explosive platform removals can cause sublethal effects on threatened and endangered marine mammals by interference with communications, disturbance of behavior, reduction of hearing sensitivity, or induction of hemorrhaging (USDOI, MMS, 1990e). The effects within 50-150 m from the detonation site are primarily sublethal and of a temporary nature lasting less than a week; however, threatened and endangered marine mammals within 50 m to detonation would likely sustain fatal injuries. Mortalities and fatal injuries have been speculated but none have been documented. In order to minimize the likelihood of removals occurring when threatened and endangered marine mammals may be nearby, the MMS has issued guidelines for explosive platform removal to offshore operators. These guidelines include daylight detonation only, staggered charges, placement of charges five meters below the seafloor, and pre- and post-detonation surveys of surrounding waters.

It is estimated that 3,120 production platforms will be removed from the Gulf of Mexico as a result of the proposed action, prior and future OCS sales. Peak year estimates are on the order of 160 removals, Gulfwide. It is expected that structure removals will cause sublethal effects on threatened and endangered marine mammals of a short-term nature lasting less than one week from 50-150 m of the detonation site. No mortalities are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e appendix B).

The sources of acoustical pulse used in seismic surveys are generated by airguns, waterguns, or high explosives (dynamite). Should seismic generated sound waves exceed the ambient “background” noise they may cause sublethal effects by interference with cetacean communication or disturbance of behavior. Although ambient sound levels in marine environments are highly variable, effects from seismic surveys are limited because seismic sound pressure dissipates to under 200 dB at distances beyond 30 m from the acoustic source (Gales, 1982). Threatened and endangered marine mammals within 30 m to the source of acoustic transmission would be sublethally affected. However, the pressure encountered by threatened and endangered marine mammals during dives and from natural underwater sounds are often in excess of those produced by seismic activities at the acoustic source. The effects on threatened and endangered marine mammals from seismic surveys are sublethal and mostly constitute short-term avoidance behavior lasting less than one day. The vast majority of seismic surveys use air and water guns to generate pulses. It is assumed that only these methods will be used in seismic surveys as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. It is expected that effects from seismic surveys on threatened and endangered marine mammals within 30 m of detonation will be sublethal lasting less than one day.

Under the cumulative analysis, it is assumed that as many as 10 crude oil spills greater than or equal to 1,000 bbl will occur from OCS activities (platform and pipeline accidents). The average size of OCS spills (1,000+bbl) will range from 20,000 to 25,000 bbl.

It is assumed that 63 oil spills greater than or equal to 1,000 bbl will occur from import tankering in the Gulf of Mexico during the life of the proposal. Two such spills would additionally result from tankering crude oil from the TAP into the Gulf. The average size of an import tanker spill is estimated at 30,000 bbl. Of the import spills estimated, 31 are estimated to occur in nearshore waters and 21 in port areas within the northwestern (Texas) and northcentral (primarily Louisiana) Gulf of Mexico. The port areas expected to receive the greatest number of these spills include Houston/ Galveston, the LOOP, and Mississippi River ports. No ports within the northeastern Gulf (Florida) are presently receiving crude oil imports for refining; therefore, no import crude spills are assumed to occur in Florida port areas. Over 1,200 smaller spills (less than 1,000 bbl) are estimated to occur annually in nearshore and coastal areas throughout the Gulf. Of these, 75 percent are assumed to be less than 10 bbl. This category of spill includes all oil and gas industry-related spills originating from the storage, production, and transportation activities. Another 77 spills (average size of 5,000 bbl) are estimated to occur from coastwise barging of crude oil, primarily in the Texas and Louisiana coastal areas. Most of these spills are expected to occur in the GIWW.

It is further assumed that 37 oil spills (greater than 50 bbl and less than 1,000 bbl) and 985 oil spills (greater than 1 bbl and less than or equal to 50 bbl) could occur from OCS pipeline, platform, and transportation sources Gulfwide. Of these, it is assumed that fewer than 50 spills (greater than 1 bbl and less than or equal to 50 bbl) and fewer than 7 spills (greater than 50 bbl and less than 1,000 bbl) would contact coastal and estuarine waters. An additional 152 oil spills (less than 50 bbl) are assumed to occur from onshore support activities. Seventy-five percent of these are assumed to be less than 10 bbl. As indicated previously, petroleum hydrocarbons introduced into marine and coastal waters may have varied effects depending on the resource impacted, stage of weathering, and local physical and meteorological parameters. Some crude oil components are highly toxic and may cause damage to marine organisms due to the crude's aromatic content. It is anticipated that normal weathering processes encountered will detoxify the oil by breaking down the toxic components of the oil. Because many of the OCS spills will occur in deep offshore waters far from the coastline, it is assumed that only 20 percent of the spills will contact the coastline. As described under the base case, considering the locations of oil pipelines and platforms offshore, and the pattern of coastal currents, the most likely location for contact from one of these spills is along a stretch of coast extending from western Louisiana to eastern Texas. A second spill, originating in the northeastern Gulf offshore Florida, is assumed to contact the Mississippi/Alabama coast. Because of the prevailing currents offshore northwestern Florida, no spills (1,000 bbl or greater) are assumed for the northwest Florida coast, but rather contact is assumed to occur along the Mississippi/Alabama coast and within the Mississippi Sound area. Using these assumptions, one OCS spill (1,000 bbl or greater) will contact the Texas/Louisiana coast, and one will contact the Mississippi/Alabama coast. In addition, no spills are assumed to occur and contact the northwestern Florida coast because of the small amount of oil resources expected to be developed offshore, and the absence of major oil refining facilities receiving imported crude. If a spill does occur offshore, it would occur as a result of oil in transit (import tanker travelling to other parts of the Gulf or oil being piped from offshore Florida to a refinery in Mississippi or Louisiana), and would occur at a distance of at least 48 km offshore, minimizing the chances of contact to the coast. In the unlikely event of an oil spill's occurring near coastal wetlands in Florida, two oil-spill response stipulations are in place to protect Florida's coast from damaging oil spill contacts. These stipulations require operators to locate state-of-the-art mechanical oil spill cleanup and containment equipment so that response to an oil spill could be accomplished within time frames specified in the stipulation.

Petroleum product spills are of great concern because the refined products of crude oil are often more toxic than crude itself. In general refined oils are considered more toxic than crude due to the higher concentration of aromatic hydrocarbons and their greater ability to dissolve and disperse into the water column as a result of their less viscous nature. Refined oil, such as gasoline and kerosene, are likely to cause biological damage due to its toxicity over a relatively short period of time. Up to 169 petroleum product spills (11,000 bbl in size) will occur Gulfwide. Of these, eighty percent (134 spills) are estimated to occur in Texas and Louisiana port areas, along the GIWW, and near the Gulf coastline. Eight product spills are estimated to occur within Florida port areas (primarily Tampa Bay) and along the Florida west coast.

Based on the offshore source of the OCS oil spills (1,000 bbl or greater), it is assumed that only 25 percent of the oil will remain in the slick at the time of contact. The Texas, Louisiana, and Mississippi coastal barriers are discontinuous, and it is likely that as much as 33 percent of the oil will be transported through barrier passes and onto coastal wetlands. It is assumed that about 100 km of coastline and 70 ha of inshore wetlands will be affected as a result of the two spills (one contacting the northwestern Gulf coast; one contacting the northcentral Gulf coast).

Geraci and St. Aubin (1988) noted that determining risk to endangered and threatened cetaceans from an interaction with oil was extremely difficult because of the host of variables involved in the interaction. Generally, species with large ranges and mobility that feed in the water column versus at the surface or on the bottom are less vulnerable to oil. This suggests that baleen whales (such as fin whales) are the most vulnerable followed by wide-ranging odontocetes (toothed whales such as great sperm whales). Geraci and St. Aubin, (1982) suggest that endangered and threatened cetaceans are able to detect and avoid oil. Skin and eye irritation and respiratory disorders caused by contacting oil are sublethal and of a temporary nature lasting less than one month (Geraci and St. Aubin, 1988). Death or debilitating illness caused by oil ingestion or by consumption of contaminated food requires large volumes and long-term chronic interactions over several years. Long-term interactions over several years, which could shorten life expectancy or reduce fecundity, have not been studied.

It is assumed that there will be contact between threatened and endangered marine mammals and spilled oil as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. It is expected that the extent and severity of effects from oil spills of any size will be lessened by improved coastal oil spill contingency planning (Appendix D) and by active avoidance of oil spills by threatened and endangered marine mammals. In the event that oiling of threatened and endangered marine mammals should occur from oil spills (greater than or equal to 1,000 bbl), the effects would primarily be sublethal causing skin and eye irritation, choking from inhalation of toxic fumes, food reduction or contamination, and oil ingestion; fewer than 10 deaths are expected. The effects of small oil spills (less than 1,000 bbl) are expected to be solely sublethal due to the inconsiderable area affected and their rapid dispersion. The effect on threatened and endangered marine mammals from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths. All individual deaths from spilled oil will be replaced through natural recruitment within two to three generations.

In summary, a number of activities such as migration behavior, operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, seismic surveys, oil spills, commercial fishing, pathogens, and recreational whale-watching may adversely affect threatened and endangered marine mammals. Both mortalities and sublethal effects on migrating threatened and endangered marine mammals are expected from a multitude of activities. The incremental contribution of each adverse influence on threatened and endangered marine mammals cannot be determined; however, the effects from such a potentially large number of adverse sources would cause the partial loss of regional populations or species of marine mammals within the Gulf of Mexico. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a threatened and endangered marine mammal to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to threatened and endangered marine mammals and do not affect marine mammal food sources due to rapid dilution and dispersion. It is expected that helicopter flights will not disturb threatened and endangered marine mammals because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. The effects on threatened and endangered marine mammals from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects of a short-term nature lasting less than one week on threatened and endangered marine mammals from 50 to 150 m of the detonation site. No deaths are expected due to industry's compliance with the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on threatened and endangered marine mammals within 30 m of detonation will be sublethal lasting less than one day. The effect on threatened and endangered marine mammals from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths. It is expected that both routine commercial and accidental "ghost" fishing will cause fewer than five deaths of threatened and endangered marine mammals per year, resulting in a partial loss of a local population. It is expected that the effects of epidemic die-offs or mass strandings from exposure to toxins on threatened and endangered marine mammals will cause a partial loss of a regional population. It is expected that the effects of recreational whale-watching on threatened and endangered marine mammals will delay fewer than five fin and/or great sperm whales during annual migration to the Gulf of Mexico, resulting in a few losses of a localized population.

CONCLUSION: Under the cumulative scenario, there will be a partial loss of a regional population of threatened and endangered marine mammals, resulting in a change in distribution and/or abundance in the Gulf of Mexico Region. Epidemic die-offs or strandings is considered the most damaging to Gulf of Mexico threatened and endangered marine mammal populations. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a(3)) to the cumulative impact is negligible because it is expected that from the proposed action there would be no discernible decline in an endangered or threatened marine mammal population or species, and no change in distribution or abundance.

2) Nonendangered Species

This cumulative analysis considers the present status of populations of nonendangered marine mammals, and the effects of impact-producing factors related to commercial fishing; removal of live specimens for public display; pathogens; State oil and gas activity; crude oil imports by tanker; and the proposed action, prior, and future OCS sales that may occur and adversely affect those populations. These impact-producing factors are discussed in Section IV.D.1.c.

Commercial fishing equipment entangles and drowns nonendangered cetaceans during routine activities or during accidental "ghost" fishing by lost or discarded gear (Tucker and Associates, Inc., 1990). Although the extent of incidental take and death during "ghost" fishing is largely undocumented, it has been noted as an activity of concern by the NMFS and the Marine Mammal Commission. It is expected that both routine commercial and accidental "ghost" fishing will cause fewer than 10 deaths of cetaceans per year, resulting in a partial loss of a local population. Should the adverse affects from commercial and "ghost" fishing cease, the affected population would recover within one to two generations.

Nonendangered cetaceans are captured and removed for public display and research. These activities are concentrated on bottlenose dolphin and not all endeavors are successful. Catch quotas are set by the NMFS to assure a sustainable yield, and capture is occasionally banned if populations are considered depleted. It is assumed that bottlenose dolphins will be captured and removed from the Gulf of Mexico. The effects on those dolphins that elude or escape capture are expected to be sublethal. It is expected that live capture and removal of dolphins will cause a partial loss of a local population. Should the adverse affects from live capture and removal cease, the affected population would recover within one generation.

Epidemic die-offs or mass strandings occur in several species of nonendangered cetaceans. The causes are difficult to diagnose as has been the case with abnormal bottlenose dolphin mortality in the Gulf in 1989-1990 and along the Atlantic Seaboard in 1988 (USDOC, NMFS, 1990b). Naturally occurring and anthropogenic toxins have been the hypothesized cause. Sources include algal blooms, oil spills, ocean dumping, industrial/municipal effluents, and agricultural runoff. These concentrations are not widespread and mortalities occur in localized areas but affect regional populations. It is expected that the effects of toxins on cetaceans will cause a partial loss of a regional population. Should the adverse affects from contact with toxins cease, the affected population would recover within two to three generations.

A number of activities associated with State oil and gas operations could impact marine mammals. These would include routine operational discharges and accidental spills; support vessel traffic; and coastal geophysical and platform removal activities using explosives. The effects on marine mammals would be similar to those discussed in the base case and below.

Produced waters, drilling muds and drill cuttings discharges can potentially impact nonendangered cetaceans by displacing or reducing their food sources. These effluents are routinely discharged into offshore marine waters and regulated by USEPA's NPDES permits. An estimated 113.53 million bbl of drilling muds, 33.44 million bbl of drill cuttings, and 12.56 billion bbl of produced waters are assumed to be discharged offshore as a result of the proposed OCS exploration and production activities, Gulfwide. Offshore operational discharges are not lethal to cetaceans and are diluted and dispersed rapidly to the extent that adverse effects to cetacean food sources do not occur (API, 1989; NAS, 1983). The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (several minutes) spent traversing the plume.

Noise from helicopter and service-vessel traffic may elicit a startle reaction from nonendangered cetaceans or mask their sound reception. This effect is sublethal and at worst of a temporary nature lasting less than an hour (Gales, 1982). Dolphins and pilot whales actively seek out and accompany service vessels for some distance with no adverse effects. Service vessels could collide with and directly impact cetaceans, but due to maneuverability of dolphins and small whales and echo-location, encounters of this type are extremely rare (Slijper, 1979; Kraus, pers. comm., 1987).

An estimated 200,000 helicopter trips will be flown annually in support of the proposed action, prior, and future OCS sales. It is assumed that helicopter traffic will occur on a regular basis. The MMS prohibits the use of fixed-wing aircraft lower than an elevation of about 150 m and helicopters lower than about 300 m. It is estimated that at these elevations cetaceans would not be startled by OCS helicopter traffic. It is expected that helicopter traffic will not affect cetaceans because of special prohibitions and adherence to the general FAA recommended minimum ceiling of 300 m.

Service vessels comprise the greatest amount of marine traffic associated OCS activities. Noise from service-vessel traffic may elicit a startle reaction from or mask the sound reception of cetaceans within 15 m of the vessel. It is estimated that approximately 12,000 service-vessel trips per year will be completed in support of the proposed action, prior, and future OCS sales. This represents less than five percent of the total annual vessel traffic in the Gulf of Mexico. In addition, cetaceans can avoid service vessels and operators can avoid cetaceans. This startling effect is sublethal and at worst of a temporary nature lasting less than an hour. The effects on cetaceans from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour.

Exploration, delineation and production structures produce sounds at intensities and frequencies that can cause sublethal effects by inhibition of the ability of a cetacean to acoustically locate its prey. However, the decibel levels of these sounds dissipate to the tolerance of most cetaceans within 15 m of the sound source. It is estimated that about 268 exploration and delineation wells and about 172 development wells will be drilled annually and produce sounds at intensities and frequencies that could be heard by cetaceans. It is estimated that noise from drilling activities will last no longer than five months at each location. However, the decibel level of these sounds dissipates to the tolerance of most cetaceans within 15 m of the source. The effects on cetaceans from platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour.

Explosive platform removals can cause sublethal effects on nonendangered cetaceans by interference with communications, disturbance of behavior, reduction of hearing sensitivity, or induction of hemorrhaging in nonendangered cetaceans (USDOI, MMS, 1990b). The effects within 50-150 m from the detonation site are primarily sublethal and of a temporary nature lasting less than a week; however, nonendangered cetaceans within 50 m to detonation would likely sustain fatal injuries. Mortalities and fatal injuries have been speculated but none have been documented. In order to minimize the likelihood of removals occurring when nonendangered cetaceans may be nearby, the MMS has issued guidelines for explosive platform removal to offshore operators. These guidelines include daylight detonation only, staggered charges, placement of charges five meters below the seafloor, and pre- and post-detonation surveys of surrounding waters. It is estimated that 3,120 production platforms will be removed from the Gulf of Mexico as a result of the proposed action, prior, and future OCS sales. Peak year estimates are on the order of 160 removals, Gulfwide. It is expected that structure removals will cause sublethal effects on nonendangered cetaceans of a short-term nature lasting less than one week from 50 to 150 m of the detonation site. No mortalities are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e appendix B).

The sources of acoustical pulse used in seismic surveys are generated by airguns, waterguns, or high explosives (dynamite). Should seismic generated sound waves exceed the ambient "background" noise they may cause sublethal effects by interference with cetacean communication or disturbance of behavior. Although ambient sound levels in marine environments are highly variable, effects from seismic surveys are limited because seismic sound pressure dissipates to under 200 dB at distances beyond 30 m from the acoustic source (Gales, 1982). Nonendangered cetaceans within 30 m to the source of acoustic transmission would be sublethally affected. However, the pressure encountered by cetaceans during dives and from natural underwater sounds are often in excess of those produced by seismic activities at the acoustic source. The effects on cetaceans from seismic surveys are sublethal and mostly constitute short-term avoidance behavior lasting less than one day. The vast majority of seismic surveys use air and water guns to generate pulses. It is assumed that only these methods will be used in seismic surveys as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. It is expected that effects from seismic surveys on cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Oil spills resulting from the OCS program and import tankering were described in the previous section under threatened and endangered species. That description includes assumptions of oil spill occurrence, spill sizes, and likely contacts with shoreline and wetlands areas.

Geraci and St. Aubin (1988) noted that determining risk to nonendangered cetaceans from an interaction with oil was extremely difficult because of the host of variables involved in the interaction. Generally, species with large ranges and mobility that feed in the water column versus at the surface or on the bottom are less vulnerable to oil. Geraci and St. Aubin, (1982) suggest that cetaceans are able to detect and avoid oil. Skin and eye irritation and respiratory disorders caused by contacting oil are sublethal and of a temporary nature lasting less than one month (Geraci and St. Aubin, 1988). Death or debilitating illness caused by oil ingestion or by consumption of contaminated food requires large volumes and long-term chronic interactions over several years. Long-term interactions over several years, which could shorten life expectancy or reduce fecundity, have not been studied.

It is assumed that there will be contact between nonendangered cetaceans and spilled oil as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. It is expected that the extent and severity of effects from program-related oil spills of any size will be lessened by improved coastal oil spill contingency planning (Appendix D) and by active avoidance of oil spills by cetaceans. In the event that oiling of cetaceans should occur from oil spills greater than or equal to

1,000 bbl, the effects would primarily be sublethal causing skin and eye irritation, choking from inhalation of toxic fumes, food reduction or contamination, and oil ingestion; fewer than 10 deaths are expected. The effects of small oil spills (less than 1,000 bbl) are expected to be solely sublethal due to the inconsiderable area affected and their rapid dispersion. The effect on cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation.

In summary, a number of activities such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, seismic surveys, oil spills, commercial fishing, removal of live specimens for public display, and pathogens may adversely affect nonendangered cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that helicopter flights will not disturb cetaceans because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. The effects on cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects of a short-term nature lasting less than one week on cetaceans from 50 to 150 m of the detonation site. No deaths are expected due to industry's compliance with the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on cetaceans within 30 m of detonation will be sublethal lasting less than one day. The effect on cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths. It is expected that both routine commercial and accidental "ghost" fishing will cause fewer than 10 deaths of cetaceans per year, resulting in a partial loss of a local population. It is expected that live capture and removal of dolphins will cause a partial loss of a local population. It is expected that the effects of epidemic die-offs or mass strandings from exposure to toxins on cetaceans will cause a partial loss of a regional population.

CONCLUSION: Under the cumulative scenario, there will be a partial loss of a regional population of nonendangered cetaceans, resulting in a change in distribution and/or abundance in the Gulf of Mexico. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation. Epidemic die-offs or strandings is considered the most damaging to Gulf of Mexico nonendangered cetacean populations. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a(3)) to the cumulative impact is negligible because it is expected that from the proposed action there would be no discernible decline in a cetacean population or species, and no change in distribution or abundance.

(b) Alaska Region

1) Threatened or Endangered Species

a) Cetaceans

i. Bowhead Whale

The hunting of bowhead whales by Alaskan Native subsistence hunters currently is the major effects-producing agent on the bowhead whale population. Each year spring-migrating bowhead whales are hunted in the northern Bering and Chukchi Seas and again on their fall migration in the Beaufort Sea. A quota of 44 strikes or 41 bowheads landed was authorized by the International Whaling Commission (IWC) in 1989. Alaskan Natives are allowed this level of harvest under the supposition that it still provides for a slow growth of the endangered bowhead whale population.

The hunt for bowhead whales by Alaskan Natives typically involves the pursuit of whales in heavy skiffs powered by outboard motors and paddles, modern shoulder guns that fire internally exploding devices (bombs), and whale floats that assist in tiring and locating the stricken whales. Animals that are not found after a strike often die later or escape with substantial injuries. Animals that are pursued but not stricken, and animals that are in the vicinity of a strike, are likely to experience a significant amount of disturbance—particularly when cow-calf pairs are nearby. Brown (1982) indicates that whales that are being hunted typically flee (and the noise associated with hunting vessels), and that hunted whales apparently do not habituate to being hunted or to other forms of overt harassment.

Consequently, whenever Native hunting vessels are in the vicinity, whales are likely to strongly avoid them and the noise associated with them. Bowhead whales that are incidentally approached by Natives hunting beluga whales, seals, and walruses are likely to avoid these vessels for the same reasons. Hence, in areas where bowheads are traditionally hunted by Alaskan Natives, bowheads are likely to be more sensitive to noise, particularly to noise that sounds like approaching hunters. It is unknown whether hunting pressures have resulted in bowheads migrating farther offshore or more under the ice to avoid areas where they are traditionally hunted. Assuming the current estimated population to be accurate, and assuming that subsistence hunting for bowhead whales continues at present rates, this activity is estimated to have lethal effects on about 0.56 percent of the bowhead whale population each year. In addition, this activity is expected to have sublethal effects on up to 40 percent of the population each year. Sublethal effects would range from moderate avoidance to substantial injuries sustained while attempting to escape hunters.

Some effects on bowhead whales may occur from oil and gas operations associated with previously held Federal offshore lease sales. Generally, bowhead whales remain far enough offshore to be found only in Federal waters. Effects could result from avoidance of vessels, air and sea seismic surveys, dredging, drilling, drillships, and production operations that occur within several kilometers of the whales. Behavioral studies have suggested that bowheads may habituate to noise from distant ongoing drilling, dredging, or seismic operations (Richardson et al., 1985a,b), but avoidance does occur (Davis, 1987). There is insufficient evidence to indicate whether or not industrial activity in an area for a number of years would adversely affect bowhead use of that area (Richardson et al., 1985a, b), and there has been no documented evidence that noise from OCS operations would serve as a barrier to migration.

If past experience is used to predict future trends, fall-migrating bowheads may be exposed to an average of zero to two exploratory operations per year. Bowheads that approach these sites would be expected to react as previously described, making deflections in their individual swimming paths within the migration corridor to avoid drilling noise associated with OCS drill sites. Noise from drilling operations is expected to ensonify a portion of the bowhead-migration corridor and affect a portion of the bowhead population. The width and location of the overall fall bowhead whale migration corridor probably would remain the same. Assuming that exploration on the Alaskan OCS continues at present rates, noise associated with these activities is estimated to cause from up to 15 percent of the bowhead population to swim around sources of noise from existing oil and gas operations each year. Most whales are expected to avoid such activities at 1 to 4 km; but for others subtle avoidance may occur at 10 to 20 km.

Oil and gas activities associated with the proposal also would affect this species through noise disturbance. Noise-producing activities that could affect fall migrating bowheads include aircraft traffic, icebreaker or other vessel traffic, geophysical-seismic surveys, artificial-island construction, drilling operations, pipeline construction, and production. The effect of these activities on migrating bowheads, for the most part, have been described previously and bowhead responses could be termed as avoidance. The cumulative case assumes the drilling of 109 exploration wells and 1,023 production wells and the placement of 18 platforms within the range of the bowhead whale. However, many of these activities are expected to occur when bowheads are not present, because bowheads are only transients through Alaska. Assuming that the drilling of these wells and placement of these platforms occurs, noise associated with these activities is estimated to cause from up to

25 percent per year of the bowhead population to swim around these sources of noise. Most whales are expected to avoid such activities by 1 to 4 km but for some avoidance may occur at 10 to 20 km.

Accidental activities that could affect bowhead whales in the cumulative case include crude-oil spills associated with the proposal. The cumulative-case estimates`that four platform, five pipeline, and six tanker spills would occur on the OCS over the life of the proposal within the range of the bowhead whale. If an oil spill occurs, possible effects on bowheads would include those already discussed for the base case, including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency for up to a couple of days, and skin and/or sensory-organ damage. However, due to the transitory movement of bowhead whales through the Alaskan OCS, it is improbable that many whales would encounter an oil spill while on the Alaskan OCS. Assuming that the estimated number of pipeline and tanker spills occur, it is estimated that they would affect from up to 20 percent of the bowhead whale population over the life of the proposal.

In summary, in considering the combined effects from subsistence hunting, previous Federal oil and gas lease sales, and the proposed 5-year program, a clearer picture of cumulative effects on bowhead whales can be seen. Despite the fact that up to 44 bowheads may be killed or seriously injured per year, and many more would experience a significant level of disturbance due to subsistence hunting by Alaskan Natives, the bowhead whale population is growing (according to IWC population estimates). Subsistence hunting for bowhead whales is estimated to have lethal effects on about 0.56 percent of the bowhead whale population each year and sublethal effects on up to 40 percent of the population each year. The proposed 5-year program is estimated to cause from up to 25 percent of the bowhead population to swim around sources of industrial noise each year. Most whales are expected to avoid such activities at 1 to 4 km; but for others, avoidance may occur at 10-20 km.

The cumulative-case estimates that four platform, five pipeline, and six tanker spills would occur on the OCS over the 30-year life of the proposal within the range of the bowhead whale. Effects would be as discussed for the base case. Due to the transitory movement of bowhead whales through the Alaskan OCS, it is improbable that many whales would encounter an oil spill while on the Alaskan OCS. Assuming that the estimated number of pipeline and tanker spills occur, it is estimated that they would affect from up to 20 percent of the bowhead whale population over the life of the proposal.

CONCLUSION: Under the cumulative scenario, it is estimated that subsistence hunting will have lethal effects on about 0.56 percent of the bowhead whale population each year. Sublethal effects from subsistence hunting, noise, and oil spills are expected on up to 40 percent of the population. No lethal effects are anticipated due to the proposal. Sublethal effects due to noise are expected on 25 percent of the population each year due to the proposal. Oil spills, as a result of the proposal, could have sublethal effects on up to 20 percent of the population. None of the above sublethal effects on bowheads are expected to affect recruitment or distribution of the species.

ii. Fin and Humpback Whales

Commercial fishing is a relatively large industry in Alaska with major fisheries for salmon, herring, shellfish, and groundfish. Fishing activity, both commercial and subsistence, probably has some effect on fin and humpback whales through noise disturbance caused by fishing vessels. The effects of individual vessels are expected to be low; however, the combined effects of several vessels in an area can produce a zone of high sound level, and may cause whales to avoid the noise at a greater distance. Another potential effect that may occur, but has not been studied to any extent, is competition between fishermen and whales for species such as herring and pollock used by whales as a food resource. Assuming that commercial and subsistence fishing continues at present rates, these activities are estimated to affect from up to 20 percent of the fin and humpback population per year by causing them to swim around these activities.

Tankering and shipping could affect fin or humpback whales in that the whales may attempt to avoid ships that approach them closely. Areas having more concentrated shipping traffic, such as Unimak Pass, may cause fin and humpback whales to avoid ships in these areas to a greater extent. Humpback whales that winter near the Hawaiian Islands are exposed to a high degree of noise and traffic associated with jet skiing, parasailing, fishing, diving, pleasure boating, and whale watching. There has not been a detectable decline in the wintering population; however, the whales do appear to be moving farther offshore away from the most congested waters (Salden, 1988). This behavior may be detrimental to reproduction or calf rearing since cow/calf pods prefer nearshore shallow waters (Smultea, 1989). However, most of the tanker and shipping routes are far offshore, and may not affect fin or humpback whales often. Also, because summer-whale concentrations on the Alaskan OCS appear to occur in areas void of OCS development, it is improbable that many individuals would be affected by the noise that shipping in these areas generates. Assuming that tankering and shipping continue at present rates, these activities are estimated to affect from up to 15 percent of the fin and humpback population each year, by causing them to swim around these activities.

A limited amount of OCS exploration is expected in Alaska due to past lease sales within the range of fin and humpback whales. However, a number of previous lease sales have occurred within the Bering Sea and Gulf of Alaska, and there are a few active leases on which exploration could occur. Off the California coast, it appears that OCS oil and gas activities are generally not affecting fin and humpback whales on their summer ranges, but there is considerable OCS activity along their migration corridor. Noise from these activities would probably cause fin and humpback whales to avoid them at 1 to 4 km. Malme et al. (1985) could find no clear evidence of avoidance of sound-playback sources from several types of industrial activity by feeding humpback whales in southeast Alaska. They also concluded that the avoidance criteria derived for the gray whale could be applied to feeding humpback whales—500 m for a drilling platform, 22 m for a helicopter, 1 km for a drillship, and 1 to 2 km for seismic surveys. Assuming that exploration on prior leases continues at present rates, these activities are estimated to affect from up to 10 percent each year of the fin and humpback population each year, by causing them to swim around these activities.

Oil and gas activities associated with the proposed program would affect fin and humpback whales through noise disturbance. The cumulative case assumes the drilling of 501 wells and placement of nine platforms within the range of fin and humpback whales. Noise-producing activities may include aircraft traffic, icebreaker or other vessel traffic, geophysical-seismic surveys, artificial-island construction, drilling operations, pipeline construction, and production. The effect of these activities on whales have been described previously and could be termed as avoidance. These activities would be estimated to cause from up to 25 percent each year of the bowhead population to swim around these sources of noise. Most whales are expected to avoid such activities at 1 to 4 km; but for others, avoidance may occur at 10 to 20 km.

Accidental activities that could affect fin and humpback whales in the cumulative case include crude-oil spills associated with the proposed program. The cumulative case of the proposed program assumes two pipeline oil spills greater than or equal to 1,000 bbl within the range of this species. However, only a few humpbacks (from Southeast Alaska) appear to migrate along the Pacific coast toward wintering grounds off Mexico. Consequently, the population would be exposed to potential oil spills from a single area (Gulf of Alaska whales) or a few areas (Bering Sea whales), and only a portion of the population would be expected to be exposed to oil-spill risk from activities within both the Alaska and Pacific OCS regions. If an oil spill were to occur, effects on humpback and fin whale populations vary depending on where the oil spill occurs and the time of year. Effects would include those already discussed for bowheads in the base case, including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency for up to a couple of days, and skin and/or sensory-organ damage.

Oil tankers transporting North Slope crude depart the Port of Valdez carrying approximately 2 MMbbl per day for markets on the Pacific coast, Gulf of Mexico, Hawaii, and Nikiski refinery in

Cook Inlet, Alaska. These tankers traverse the Gulf of Alaska area and all of the Pacific areas. Approximately 5 tanker spills are projected for the cumulative case in these areas as a result of North Slope crude-oil tankering. However, most of the tanker routes are far offshore, and any oil spills occurring in these areas may not affect fin or humpback whales. Also, because summer concentrations appear to occur in areas void of OCS development, it is improbable that many individuals would contact multiple oil spills or that more than a few individuals would be affected. Assuming the estimated number of oil spills for the proposed 5-year program occurred, it is estimated that they would affect up to 20 percent of the fin and humpback population over the life of the proposal.

In summary, routine activities that could affect fin and humpback whales in the cumulative case include commercial and subsistence fishing, prior lease sales, tankering and shipping, and the proposed 5-year program. The routine effects of these activities would be due to noise associated with vessels, seismic surveys, dredging, drilling, drillships, aircraft, and production operations. These effects have been described previously and could be termed as whales avoiding the sources of noise by swimming around them. Most whales are expected to avoid such activities at 1 to 4 km, but for others, avoidance may occur at 10 to 20 km. Because most of the tanker and shipping routes are far offshore and summer-whale concentrations on the Alaskan OCS appear to occur in areas void of OCS development, it is improbable that many individuals would be affected by the noise associated with the proposal. Assuming that commercial and subsistence fishing, prior lease sales, tankering and shipping, and the proposal occur as expected, these activities are estimated to affect a maximum of up to 25 percent of these populations each year.

Accidental activities would include the effects associated with oil spills already discussed for bowheads in the base case, including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency for up to a couple of days, and skin and/or sensory-organ damage. Because most of the tanker and shipping routes are far offshore and summer-whale concentrations on the Alaskan OCS appear to occur in areas void of OCS development, it is improbable that many individuals would be affected by an OCS oil spill. Assuming that the estimated number of tankering and pipeline oil spills for the cumulative case did occur, it is estimated that they would affect up to 20 percent of the fin and humpback whale populations over the life of the proposal.

CONCLUSION: Under the cumulative scenario routine activities associated with commercial and subsistence fishing, tankering and shipping, previous OCS lease sales, and the proposal are estimated to affect up to 25 percent of fin and humpback whale populations each year. Up to 5 percent of this is estimated to be due to the proposal. Tanker and pipeline oil spills due to the proposal are estimated to affect up to 20 percent of these species' populations over the 24- to 32-year life of the proposal. None of the above sublethal effects are expected to affect recruitment or distribution of these species.

iii. Right, Blue, Sei, and Sperm Whales

The most recent estimate of the North Pacific blue whale population is 1,530 individuals (Wada, 1977); however, there has been little new information on blue whale abundance since hunting ceased in 1967. There have been numerous sightings in the last several years off Mexico and California but no useful census data for population assessment. Given the relative scarcity of blue whales based on opportunistic sightings, the low population estimates relative to their initial abundance, and the low intrinsic rate of increase noted for this and other baleen whale populations, there is no evidence, to date, that the blue whale stocks in the North Pacific are recovering (Mizroch, Rice, and Breiwick, 1984).

The pre-exploitation population of sei whales in the North Pacific was estimated at 45,000 whales (Ohsumi and Fukuda, 1975). Catches of sei whales in the North Pacific and Bering Sea rose sharply during the 1960's and then dropped sharply thereafter. The most recent population estimates have varied between 8,600 individuals (Tillman and Grandfell, 1977) to 37,000 individuals (Ohsumi and Fukuda, 1975). There are no indications of population trends for this species.

The number of sperm whales in the eastern North Pacific stock appears to be fairly high. It is estimated that the number of individuals in the eastern North Pacific population large enough to be commercially exploitable—males aged 11 years and older and females aged 10 and over—is about 274,000 (IWC, 1979). This is approximately 88 percent of the estimated population prior to commercial exploitation. There is no information regarding recent trends for this species, and it should be noted that new analyses of population numbers using different data sets and biological parameters may produce much different population estimates (Gosho, Rice, and Breiwick, 1984). Activities that could affect these species would include commercial and subsistence fishing, tankering and shipping, previous OCS lease sales, and the proposal.

Commercial and subsistence fishing is expected to affect these species through noise disturbance associated and possibly through competition for species used by the whales for food. These effects would be as described for fin and humpback whales and would affect up to 20 percent of the population each year.

The effects of noise disturbance due to tankering and shipping have not been evaluated on these species since they are uncommon in the areas of potential OCS interest, but it is believed that they would react in ways similar to other whale species whose behaviors have been documented in the presence of noise sources. For example, blue whales still use Monterey Bay, California, despite the fact that vessel traffic there could be described as moderate. Also, a local stock of blue whales appears to be doing well in the Gulf of St. Lawrence despite being the object of whale-watching trips (Mizroch, Rice, and Breiwick, 1984). Hence, the effects of tankering and shipping on these species are expected to be as described for fin and humpback whales and would affect up to 15 percent of the population each year.

No further exploratory operations are scheduled on previous OCS leases within the range of these species; however, a number of previous lease sales have occurred within the Bering Sea and Gulf of Alaska, and active leases remain where exploration could occur. Off the California coast, it appears that OCS activities are not affecting these species. The sperm whale typically inhabits waters deeper than 200 m, and the blue and sei whales are more pelagic in nature than some of the other whale species; consequently, they most often occur in waters not occupied by OCS activities. Right whales are so scarce that it is improbable that they would interact with OCS activities at all. Assuming that activities on prior leases occur, they are estimated to affect from up to 10 percent of these species populations.

Oil and gas activities associated with the cumulative case would affect these species through noise disturbance. The proposal estimates the drilling of 501 wells and placement of nine platforms within the range of fin and humpback whales. Noise-producing activities may include aircraft traffic, icebreaker or other vessel traffic, geophysical-seismic surveys, artificial-island construction, drilling operations, pipeline construction, and production. The effect of these activities on whales have been described previously and could be termed as avoidance. Effects of this type on blue whales may be expected if oil and gas activities occur in the Santa Rosa-Cortes Ridge and Tanner-Cortes Banks areas of southern California because blue whales are known to frequent these areas. These activities would be estimated to cause from up to 15 percent of these species to swim around sources of noise each year. Most whales are expected to avoid such activities at 1 to 4 km; but for others, avoidance may occur at 10 to 20 km.

Accidental activities that could affect these species in the cumulative case would be due to oil spills associated with the cumulative case. The cumulative case assumes one platform, two pipeline, and five tanker spills greater than or equal to 1,000 bbl within the range of these species. Effects would include those already discussed for bowheads in the base case, including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency for up to a couple of days, and skin and/or sensory-organ damage. Tanker oil spills could theoretically have greater effects on blue, sei, and sperm whales, since tanker routes in most areas are farther offshore, and are closer to the more pelagic habitats utilized by these species. However, given the relative rarity of these species in areas of OCS activity and their dispersed pattern in pelagic areas, it is improbable that greater effects would occur. Assuming the estimated number of oil spills for the cumulative case actually occurred, it is estimated that they would affect up to 10 percent of these species over the life of the proposal.

Routine activities that could affect right, blue, sei, and sperm whales in the cumulative case include commercial and subsistence fishing, tankering and shipping, previous OCS lease sales, and the proposed 5-year program. The effects of these activities would be due to noise associated with vessels, seismic surveys, dredging, drilling, drillships, aircraft, and production operations. The effect of these activities on whales has been described previously and could be termed as whales avoiding the source of noise by swimming around it. Most whales are expected to avoid such activities at 1 to 4 km; but for others, avoidance may occur at 10 to 20 km. Due to their low numbers and preference for other habitat areas, it is improbable that these species would interact with any of these activities often (particularly right and blue whales). Assuming that commercial and subsistence fishing, tankering and shipping, previous OCS lease sales, and the proposed 5-year program occur as expected, these activities are estimated to affect a maximum of up to 20 percent of these populations each year.

Accidental activities would include the effects associated with oil spills already discussed for bowheads in the base case, including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency for up to a couple of days, and skin and/or sensory-organ damage. Additionally, these species tend to be well dispersed in pelagic habitats and are not likely to be contacted by an oil spill. Assuming the estimated number of tankering and pipeline oil spills for the cumulative case occurred, it is estimated that they would affect up to 20 percent of these species populations over the life of the proposal.

CONCLUSION: Under the cumulative scenario, routine activities associated with commercial and subsistence fishing, tankering and shipping, previous OCS lease sales, and the proposal are estimated to have sublethal effects on up to 20 percent of right, blue, sei, and sperm whale populations each year. Up to 5 percent of this is estimated to be due to the proposal. Sublethal effects from spilled oil due to the proposal are expected on up to 10 percent of the population over the 24-32 year life of the proposal. None of the above sublethal effects are expected to affect recruitment or distribution of the species.

b) Pinnipeds

STELLER SEA LION: Activities that could produce adverse impacts on the Steller sea lion population in Alaska include routine and accidental activities associated with oil and gas development on current and future State of Alaska leases in Cook Inlet, transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP, transport of oil from the TAP by tanker to Cook Inlet refineries, transport of Cook Inlet production to Far East markets, commercial-fishing operations, pollution, and subsistence harvest activities.

Routine noise and activity and oil spills (discussed under the base case) associated with future oil and gas development on Federal leases in the Gulf of Alaska, Cook Inlet, and the Bering Sea (proposal) could adversely impact the sea lion population. Oil spills, the primary accidental factor affecting sea lions, are expected to result in sublethal effects if they contact adult sea lions or habitats where they may become oiled secondarily; contact with pups is more likely to be lethal. Transport of future arctic OCS production from the TAP by tanker represents an additional source of oil spills. Spill cleanup operations are expected to cause sea lions to temporarily abandon the affected areas; disturbance of rookeries is expected to be especially adverse. Sea lion distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

Because few individuals are likely to be exposed, the impact of routine noise and activity associated with State leases is expected to be minimal. A tanker spill in Prince William Sound, and more especially to the west and south where a spill is likely to travel once it leaves the sound (as shown by the *Exxon Valdez* incident), is expected to cause displacement of individuals, potential disruption of female-pup bonds, and pup mortality requiring two generations or more for recovery in this most precipitously declining portion of the population. A spill originating on a State lease in Cook Inlet would have similar effects. Likewise, a tanker spill in Unimak Pass is expected to cause similar impacts in the eastern Aleutian-western Alaska Peninsula population, requiring two generations or more for recovery. Disturbance from oil-spill containment and -cleanup activities is expected to have a substantial effect on local concentrations of sea lions, causing abandonment of habitat for a variable period, and requiring the equivalent of a generation for recovery to the original population condition.

The impact on sea lions of interactions with commercial fisheries is not well known, although it is almost certainly a contributing factor in the species' recently observed decline. For example, declines in prey preferred by sea lions occurring recently are assumed to have some relationship to increases in commercial- fishing catch of these fish species. The extent of incidental mortality in fishing gear and directed kill is not well known, but estimates as high as about 3,000 annually have been made (Hoover, 1988). Subsistence harvest of sea lions is relatively small, probably not exceeding 500 animals annually over the entire range. Effects of pollution other than oil on the sea lion population are not known, but pollutants may have an adverse affect on availability of food organisms. Losses from subsistence and pollution are expected to require one generation or more for recovery. The current declining status of this population suggests that recovery from incidental-take mortality and, potentially, declining preferred fish stocks, is not expected to occur until losses from these factors decrease substantially.

Routine air support activity associated with Federal OCS development may disturb sea lions on Amak Island near Cold Bay or in the Pribilof Islands (from St. George Basin) and in the northern Kodiak archipelago (from Cook Inlet), but impacts are expected to be minimal and require less than the equivalent of a generation for recovery. Impacts of oil spills (discussed under the base-case scenario) originating from Cook Inlet and Gulf of Alaska lease areas, tankers transporting arctic oil from the TAP, or tankers in the vicinity of Unimak Pass transporting oil from Navarin and St. George Basins are expected to be similar to those described above, requiring two generations or more for recovery. Because of the relatively limited migratory habits of sea lions, only a portion of the western Gulf of Alaska population is expected to be exposed to more than one spill during the projects included on the 5-year program. Fuel spills from support vessels that contact sea lion concentrations, though likely to dissipate quickly, are expected to cause losses requiring a generation for recovery. Impacts from oil-spill-cleanup activities are expected to be as described above, requiring up to a generation for recovery in local areas.

In summary, the impact of oil spills from non-OCS oil and gas development on Steller sea lions in Prince William Sound, the Gulf of Alaska, or the Unimak Pass-eastern Aleutian area are expected to result in losses requiring two generations or more for recovery to the original population condition. Spill-cleanup operations are expected to cause local impacts requiring up to a generation for recovery. Impacts of subsistence harvests and pollution on the sea lion population are not well known, but probably cause losses requiring more than the equivalent of a generation for recovery. Recovery from fisheries incidental-take mortality and, potentially, declining preferred fish stocks, is not expected to occur until losses from these factors decrease substantially. Impact of routine disturbance from OCS development is expected to require less than one generation for recovery. Impact of oil spills and cleanup activities of OCS origin are expected to be similar to those described for non-OCS sources, requiring two generations or more for recovery.

CONCLUSION: Overall cumulative impact on the Alaskan Steller sea lion population is expected to require six generations or more for recovery (minimum of 36 years). However, if the current population decline is not reversed recovery may not occur in the foreseeable future. Principal components of this impact are fisheries incidental take mortality, potentially, declining preferred fish stocks, non-OCS and OCS oil and gas development and subsistence harvest. The first two are assumed to greatly exceed all other factors and recovery from these two factors is not expected to occur until losses decrease substantially. Substantial adult mortality is not expected as a result of spilled oil due to the proposal. However, considerable pup mortality and adverse effects on juveniles are expected. These effects would require up to 3 generations for recovery.

2) Nonendangered Species

a) Cetaceans

i. Beluga Whale

The primary cumulative effects on beluga whales in the Alaska Region are associated with the following activities: commercial fishing in the Bering Sea and Gulf of Alaska; Federal OCS and State of Alaska oil and gas activities in the Arctic, Bering Sea and Gulf of Alaska; and subsistence harvest of beluga whales.

The actual and potential effects of commercial fishing in the Bering Sea on beluga whales include the following: (1) direct mortality from entanglement in fishing gear and from other interactions (shooting of whales raiding fishing nets); (2) competition for prey/commercial fish species that could reduce the availability of prey for beluga whales; and (3) displacement of beluga whales due to noise and disturbance from boats associated with intense fishing activities. The entanglement of beluga whales in the salmon gillnet fishery in Bristol Bay is an additive source of mortality for this population of belugas. Competition for fish (particularly pollock) is known to occur between Beluga Whales and commercial fishing. Migratory beluga whales occurring in the Arctic during the summer and occurring in the Bering Sea during the winter have experienced direct mortality and food-competition from commercial fishing in the northern Bering Sea, which involves a much smaller number of operations (probably a few hundred boats) than that occurring in the southern Bering Sea and Bristol Bay (thousands of boats and spotter aircraft). Arctic beluga whales are not exposed to such intense fishing activities during the winter months when they migrate to the Bering Sea as whales that summer in the Bristol Bay area. However, the amount of commercial-fishing activity is increasing in the northern Bering Sea and in Norton Sound. Beluga whales in both the northern and southern Bering Sea are exposed to an increasing amount of vessel traffic associated with expanding commercial-fishing operations. There is no question that temporary displacement (minutes to hours to 2-3 days) of beluga whales occurs as a result of vessel traffic associated with commercial fishing in Bristol Bay and in Norton Sound. Longer displacement (several days to a few months) of beluga whales probably occurs in areas of intense commercial-fishing activity.

Beluga whale populations occurring in the Alaska Region are hunted by Natives in Alaska and in Canada with about 300 whales taken in the Beaufort Sea, 150 whales taken in the Chukchi Sea, 100 to 120 whales taken in the Bering Sea, and about 10 whales taken in Cook Inlet (Burns et al., 1985b). International subsistence hunting of beluga whales is believed to have no more than an annual effect on the abundance of beluga whales with harvest levels below the natural recruitment levels of the populations.

Migratory populations of beluga whales occurring in the Arctic have been exposed to oil-exploration activities (seismic surveying, drilling, vessel traffic, dredging, and gravel-dumping operations) in the Beaufort Sea and exposed to some of these activities in the Bering and Chukchi Seas and Gulf of Alaska. The exposure of the beluga whale populations to the above activities and to other marine-vessel traffic (oil-field sealift-barge traffic to the North Slope and increased icebreaker activity in support of Chukchi Sea oil exploration) is likely to increase in the near future. These industrial activities are expected to have some short-term (less than 3 years) effects on the distribution of migratory beluga whales during the drilling season and during the installation of the platforms and pipelines. Assuming offshore oil development occurs, some local (within 1-3 mi) changes in the distribution of beluga whales would occur. However, some habituation of beluga whales to marine traffic, and to industrial noise is expected to occur; and the displacement associated with cumulative industrial activities or coincidental to such activities is not expected to result in a reduction in the overall abundance, productivity, or distribution of beluga whales in the Alaska Region. Noise and disturbance associated with present and future proposed oil and gas activities on beluga whales are expected to have short-term (less than 3 year) effects on the distribution of beluga whales.

Cumulative oil-spill risks to beluga whale habitats will increase over the spill risks from the proposed action during the spring migration in the Chukchi-Point Barrow lead system. Seven oil spills are assumed in the cumulative case in the Beaufort and Chukchi Seas Planning Areas. The increase in spill risk to the lead system would be attributed to oil activities associated with Federal OCS oil and gas lease sales in the Beaufort Sea. Spills that occur during the winter and persist in the Arctic until after meltout from the ice pose the highest risk to the Chukchi Sea-Point Barrow lead system.

Oil spills associated with cumulative oil and gas exploration and development (oil-well blowouts, pipeline spills, and particularly tanker or other marine-vessel fuel spills) are expected to have short-term (less than one generation) effects on beluga whales. Biological effects of such contact are expected to be sublethal for most beluga whales, although very stressed whales exposed to concentrations of oil vapors and toxic gases for several days could die from physiological stress (perhaps 10 to fewer than 100 whales are expected to be lost). Spills assuming to occur in the Bering Sea and Gulf of Alaska are expected to have similar effects as described above from spills in the Arctic.

Cumulative noise and disturbance of beluga whales during spring migration from icebreaker and other marine vessel traffic in the Beaufort and Chukchi Seas might delay spring migration (for a few days) of a portion of the whale population due to frequent vessel traffic and icebreaker activities in the ice-lead system. A delayed migration could theoretically result in a reduction in the availability of and time spent by the whales in summer-feeding and molting habitats. Cumulative noise and disturbance effects on beluga whales from perhaps 200 vessel trips per year are expected to change the distribution of beluga whales during seasons of high vessel traffic and extended icebreaker activity. Disturbance reactions of beluga whales would be brief with the affected animals returning to normal behavior patterns and distribution within a short period (such as a few minutes to no more than few days) of time after the boats and icebreakers have left the area or stopped icebreaking activities. Disturbance reactions are not likely to be additive from one year to the next because the whales would not be continuously exposed to icebreaking ships or high levels of other marine traffic.

Exploration-drilling units and 21 future production platforms throughout the Beaufort and Chukchi Seas and Hope Basin are expected to have local (within a 1- to perhaps 3-mi) effects on ice movements and fast-ice formation around the 21 platforms. The changes in ice movements and ice formation are likely to have no overall effect on beluga whale distribution. Natural variation in ice conditions and resulting changes in beluga whale distribution are likely to reverse or overcome any possible changes in the movements of belugas associated with the presence of exploration and production platforms.

In summary, cumulative activities that affect beluga whales occurring in the Alaska Region include oil and gas activities, commercial fishing, and the hunting/harvest of beluga whales. Commercial fishing has had the following effects on beluga whales: direct mortality from entanglement in fishing gear, the shooting of whales near fishing operations, competition for prey/commercial fish species, and disturbance/displacement from vessel traffic associated with commercial fishing. Increases in the number of fishing vessels and increases in fish-harvest rates may result in long-term (more than 10 years) displacement of beluga whales occurring in the Bering Sea. Increases in fisheries activities also are expected to cause an increase in the direct mortality of beluga whales that interact with fishing operations in the Bering Sea and result in an increase in competition for prey/commercial fish species that might result in a long-term (more than 10 years) effect on the productivity and abundance of the beluga whale population in the Bering Sea.

Beluga whales are expected to suffer low mortality (perhaps 10 to less than 100 individuals) from the eight cumulative oil spills that are assumed to occur and contact this species habitats in the Arctic, as well as some of the spills in the Bering Sea (total of 4) and in the Gulf of Alaska (8 spills) contacting beluga whale habitats, perhaps resulting in the death of no more than 100 highly stressed whales. This loss is expected to be less than losses due to natural causes such as disease, accidental strandings, and predation. Noise and disturbance reactions of beluga whales are likely to be brief, with the affected whales returning to normal behavior patterns and distribution within a short period of time (minutes to no more than several days after boats and icebreakers have left the area or till icebreakers cease icebreaking operations). Cumulative noise and disturbance effects on beluga whale distribution are expected to persist seasonally for no more than 3 years during exploration and during platform installation. Cumulative noise and disturbance and local (within perhaps 1-3 mi) ice-habitat alterations associated with platform construction or installation could temporarily affect beluga whale distribution very near (within 1 mile) of the platforms located in Arctic habitats, but such possible changes are likely to be less than the natural changes in whale movements caused by natural changes in ice conditions.

CONCLUSION: The overall cumulative effect of oil and gas activities (primarily noise and disturbance and oil-spill effects), commercial fishing (mortality due to entanglement in fishing gear, noise and disturbance, and competition for fish populations), and hunting/harvest is expected to have both short-term (less than 3 years), and long-term (more than 10 years) effects on these beluga whale populations in the Alaska Region. The contribution of the proposal (noise and disturbance and oil spills) to the overall effect is generally expected to be short term (less than 3 years).

ii. Minke Whale

Minke whales are abundant worldwide, and there has been speculation that numbers have been increasing throughout the species' range (Green et al., 1989; Bonnell and Dailey, 1990). Factors that may produce cumulative effects on minke whales in the Pacific and Alaska Regions include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to minke whales include commercial shipping activities and Alaskan and foreign-import tankering.

Nishiwaki and Sasao (1977) suggest that increased ship traffic in Japanese waters has disturbed the migration routes of minke whales. No such observations have been made on the population in the northeast Pacific. Although the effects of current and future vessel traffic on minke whales is unknown, minkes calving in southern California waters are probably the segment of the population most sensitive to such disturbance. However, few minke whales are present in the Southern California Bight during the winter calving season, and the peak spring migrant population in the area is estimated at less than 70 animals (Bonnell and Dailey, 1990). Given these low densities, little impact on minke whales is expected from ship traffic. Vessel traffic associated with OCS activities in the Alaska and Pacific Regions is not expected to contribute measurably to this source of disturbance.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the minke whale population. Two of these, the tankering of Alaskan-produced oil through the TAPS and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

It is assumed for the cumulative case that a total of 17 spills (ranging in size from 7,000 to 30,000 bbl) from non-OCS and OCS sources will occur in the Pacific Region over the 35-year life of the proposed action (see Section IV.D.1.c). This total includes 5 TAPS tanker spills, 5 import tanker spills, and 7 OCS spills. The OCS total includes a combination of spills from platforms, pipelines, and the tankering of Alaskan OCS oil. Assuming uniform distribution of spills over the life of the proposal, the average number of spills per year from all these sources is approximately 1 spill every 2 years. In the Alaska Region, 23 spills (of 20,000 to 30,000 bbl each) are assumed to occur over a 40-year period. This total includes 6 TAPS tanker spills in the Gulf of Alaska and 17 OCS platform, pipeline, and tanker spills, for an assumed number of spills of a little more than 1 spill every 2 years. For purposes of analysis, it is further assumed that the spills will occur with uniform frequency and spatial distribution within each planning area over the life of the cumulative scenario. The probabilities of one or more spills occurring in the Alaska and Pacific Regions from production ranges from 87 to greater than 99.5 percent.

Since minke whales migrate through nearly all the planning areas in the Alaska and Pacific Regions, the population could be affected by a number of these spills. Effects on minke whales would be as described for the base case (Section IV.D.1.a(3)). As in the base case, accidental oil spills are generally not expected to result in minke whale mortality or to disrupt migration.

Oil spill impacts on minke whales would probably be greatest if an additional spill were to occur during the same migration cycle as a spill on the calving grounds, since cows on the calving grounds are already stressed by the demands of migration, birth, and nursing. It is likely, however, that spills would have to occur in the Alaska and Pacific Regions during critical seasons in both areas (i.e., in summer in Alaska and winter in southern California) to have more than a sublethal effect on the minke whale population. Since it is assumed that the spills will occur with uniform frequency and spatial distribution, no additive effects from multiple spills are expected.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1 to 50 bbl and 4 spills of 51 to 999 bbl will occur over the life of the proposed program (see Table IV.D.1.c-6). In the Alaska Region, it is assumed that as many as 1,938 oil spills of 1 to 50 bbl and 79 spills of 50 to 999 bbl will occur over the life of the proposed program. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are not expected to make a measurable contribution to impacts on the minke whale population.

CONCLUSION: Minke whales are abundant worldwide, and numbers may be increasing. None of the possible impacting factors identified for the cumulative scenario are expected to have effects on minke whales that are distinguishable from natural variability in the species' population in the Alaska and Pacific Regions.

b) Pinnipeds

i. Northern Fur Seal

Activities that could produce adverse impacts on the northern fur seal population in Alaska include routine and accidental activities associated with oil and gas development on current and future State of Alaska leases in Cook Inlet, transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP, transport of oil from the TAP by tanker to Cook Inlet refineries, transport of Cook Inlet production to Far East markets, commercial fishing operations, pollution, and subsistence-harvest activities.

Routine noise and activity and oil spills (discussed under the base case) associated with future oil and gas development on federal leases in the Gulf of Alaska, Cook Inlet, the Bering Sea and southern California could adversely impact the fur seal population. Oil spills, the primary accidental factor affecting fur seals, are expected to result in lethal effects if they contact seals or habitats where they may become oiled secondarily. Transport of future Arctic OCS production from the TAP by tanker through the Gulf of Alaska represents an additional source of oil spills. Spill-cleanup operations are expected to cause fur seals to temporarily abandon the affected areas. Fur seal distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

In summary, impact of routine noise and activity associated with State oil and gas leases is expected to be minimal. A tanker spill of non-OCS oil in the Gulf of Alaska is expected to cause losses in migrating fur seals requiring up to a generation for recovery, as could a spill originating on a state lease in Cook Inlet. A tanker spill in Unimak Pass during the migration period, or in the Unimak Pass-Pribilof Islands corridor during migration or breeding season, is expected to cause losses in the population requiring one generation or more for recovery. Disturbance from oil-spill-containment and cleanup activities is expected to have a substantial effect on local concentrations of seals, causing abandonment of habitat for a variable period, and requiring the equivalent of up to a generation for recovery to the original population status.

The extent of commercial-fisheries impact on the fur seal population is not well known, although it is almost certainly a contributing factor in the species' recently observed decline. For example, increased commercial-fishing catch of prey species preferred by fur seals might be expected to deplete the carrying capacity of the range, but this is not indicated by recent population data. The extent of incidental mortality in fishing gear is not well known, but at least 0.4 percent of subadult males observed on the Pribilofs are carrying net fragments or other debris, suggesting that mortality of animals at sea could be substantial. Effects of pollution other than oil on the fur seal population are not known, but pollutants may have an adverse effect on the availability of food organisms. Subsistence harvest of fur seals generally does not exceed about 3,000 animals per year. Aside from incidental mortality in fishing gear, which is unknown but may be substantial, recovery from losses due to other factors is not expected to exceed one generation.

Routine air-support activity associated with Federal OCS development may disturb fur seals on the Pribilof Islands (from St. George or Navarin Basin), but impacts are expected to be minimal and require less than the equivalent of a generation for recovery. Impacts of oil spills (discussed under the base-case scenario) originating from Cook Inlet and Gulf of Alaska lease areas, tankers transporting arctic oil from the TAP, or tankers transporting oil from Navarin and St. George Basins are expected to be similar to those described above: requiring up to one generation for recovery in the Gulf of Alaska and one generation or more for spills in Unimak Pass during the migration period or in the Unimak Pass-Pribilof Islands corridor during migration or the breeding season. When fur seals are concentrated in the vicinity of the Pribilofs during the breeding season, losses from oil-spill contact are expected to require two to three generations for recovery. Because of the dispersed offshore distribution of wintering fur seals, an oil spill in California waters is expected to contact relatively few individuals requiring less than a generation for recovery. Exposure to more than one spill is expected to increase potential impacts by less than one generation for recovery. Disturbance from oil spill cleanup activities is expected to have a substantial effect on local concentrations of seals, causing abandonment of areas for a variable period, and requiring the equivalent of up to a generation for recovery to the original population status. Any support-vessel fuel spills contacting fur seal concentrations, though likely to dissipate quickly, are expected to cause losses requiring a generation or less for recovery.

In summary, the impact of oil spills from non-OCS oil and gas development on migrating fur seals in the Gulf of Alaska is expected to result in losses requiring up to a generation for recovery. A spill in the Unimak Pass during migration, or in the Unimak Pass-Pribilof Islands corridor during migration or the breeding season, is expected to require one generation or more for recovery. The extent of incidental mortality in fishing gear is unknown but may be substantial. Recovery from losses due to subsistence harvest and pollution are not expected to exceed one generation. Impact of routine disturbance from OCS activity is expected to require less than one generation for recovery. Impacts of oil spills of OCS origin are expected to be similar to those described for non-OCS sources. In the vicinity of the Pribilofs during the breeding season, fur seal losses from oil contact are expected to require two to three generations for recovery. Spill-cleanup operations are expected to cause local impacts requiring up to a generation for recovery. An oil spill contacting fur seals in California waters is expected to require less than a generation for recovery.

CONCLUSION: Overall cumulative impact on the northern fur seal population is expected to require up to five generations for recovery during the 24- to 32-year life of the proposal. Principal components of this impact are subsistence harvest, non-OCS and OCS oil and gas development. The extent of incidental mortality in fishing gear is unknown but may be substantial. For the proposal, impacts on the fur seal population are expected to require up to three generations for recovery.

ii. Ice Seals

Activities that could produce adverse impacts in ice seal populations include routine and accidental activities associated with offshore oil and gas development on current and future State of Alaska Beaufort Sea leases, Canadian Beaufort oil and gas development, coastal operations associated with the Red Dog Mine in the southeastern Chukchi Sea, State of Alaska offshore mining program in Norton Sound, commercial fishing operations, and the subsistence harvest.

Routine noise and activity (particularly helicopters and icebreakers) and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Beaufort, Chukchi, and Bering Seas could adversely impact ice seal populations. Dredging for pipeline laying may decrease benthic prey availability. Oil spills, the primary accidental factor affecting seals, are expected to result in sublethal effects if they contact adults or habitats where they may become oiled secondarily; pups are assumed to experience lethal effects when oiled directly or through contact with oiled females. Spill-cleanup operations are expected to cause seals to temporarily abandon the affected areas; disturbance of females with pups or breeding pairs is expected to be especially adverse. Ice seal distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

Routine noise and activity associated with offshore oil and gas development on current and future State of Alaska Beaufort Sea leases and Canadian Beaufort oil and gas development are expected to have minor impacts on ringed and bearded seals, requiring less than a generation for recovery, because most of the intensive activity would occur closer to shore than seals typically are concentrated. Some seals are expected to be displaced from within several kilometers of industrial sites. Recovery from impacts of oil spills is not expected to require more than one generation because of the small proportion of the population likely to be contacted and the assumed lack of adult sensitivity to oiling. The Red Dog Mine is expected to have a minimal impact on ringed seal pupping, because an extremely small proportion of the population would occur in the vicinity of its coastal facility. The impact on spotted and ringed seals of offshore mining on State leases, including noise disturbance and disruption of benthic food resources, as well as by commercial-fishing operations, are not expected to require more than one generation for recovery because of the low numbers of individuals affected and the relatively small proportion of available habitat disturbed. Impact of the current Alaskan subsistence harvest (estimated 200 ribbon seals, 3,000 spotted seals, 1,000 bearded seals, 3,000 ringed seals) on the populations is not known but is expected to require one generation or less for recovery.

Recovery from impacts of routine air- and vessel-support activities associated with Federal OCS development are not expected to require more than one generation because of the small proportion of the populations likely to be exposed and the temporary nature of most effects. Likewise, pipeline dredging operations are expected to require less than one generation for recovery because only a small proportion of the seal populations would be disturbed. Recovery from impacts of oil spills is not expected to require more than one generation because of the small proportion of the population likely to be contacted and the assumed lack of adult sensitivity to oiling. However, the potential for contact of the same herds by more than one spill (e.g., Navarin Basin in spring, Chukchi Sea in summer) within a relatively short timeframe could elevate the expected recovery period to one generation or more. Impact of oil-spill- cleanup operations, especially if pursued over more than one season, is expected to require up to a generation for recovery.

In summary, routine and accidental impacts of non-OCS oil and gas development on ice seals are expected to result in losses requiring no more than one generation for recovery. Impacts of non-OCS mining, the Red Dog Mine, and commercial-fishing operations together are not expected to require more than one generation for recovery. Recovery of ice seal populations from the losses of subsistence harvests is expected to require a generation or less. Recovery from routine and accidental impacts of OCS oil and gas development is not expected to require more than one generation; however, one generation or more is expected if a segment of a population is contacted by more than one spill within a short time. Pipeline dredging and OCS mining are not expected to require more than one generation for recovery. Impact resulting from oil spill-cleanup-operations is expected to require up to one generation for recovery.

CONCLUSION: Overall cumulative impact on ice seal populations is expected to require two to three generations for recovery during the 24- to 30-year life of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development and subsistence harvests. For the proposal, impacts are expected to require one to two generations for recovery.

iii. Harbor Seal

Activities that could produce adverse impacts on the harbor seal population in Alaska include routine and accidental activities associated with oil and gas development on current and future State of Alaska leases in Cook Inlet, transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP, transport of oil from the TAP by tanker to Cook Inlet refineries, transport of Cook Inlet production to Far East markets, commercial-fishing operations, pollution, and subsistence-harvest activities.

Routine noise and activity and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Gulf of Alaska, Cook Inlet, and the Bering Sea could adversely impact the seal population. Oil spills, the primary accidental factor affecting seals, are expected to result in sublethal effects if they contact adult seals or habitats where they may become oiled secondarily; contact with pups is more likely to be lethal. Transport of future arctic OCS production from the TAP by tanker represents an additional source of oil spills. Spill-cleanup operations are expected to cause seals to temporarily abandon the affected areas; disturbance of pupping areas is expected to be especially adverse. Harbor seal distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

Because few individuals are likely to be exposed, the impact of routine noise and activity associated with State leases is expected to be minimal. A tanker spill in Prince William Sound is expected to cause displacement of individuals, potential disruption of female-pup bonds, and pup mortality requiring one generation or more for recovery. As shown by the *Exxon Valdez* incident, a spill can escape the sound and cause similar effects on this declining population to the west and south, as could a spill originating on a State lease in Cook Inlet. Likewise, a tanker spill in Unimak Pass is expected to cause similar impacts in the eastern Aleutian-western Alaska Peninsula population, requiring one generation or more for recovery. Disturbance from oil-spill containment- and cleanup activities is expected to have a substantial effect on local concentrations of seals, causing abandonment of habitat for a variable period, and requiring the equivalent of a generation for recovery to the original population condition.

The impact on seals of interactions with commercial fisheries is not well known, although it may be a contributing factor in the species' recently observed decline. Effects of pollution (e.g., Valdez, Seward, Kodiak) other than oil on the seal population are not known, but in such localities pollution may have an adverse effect on availability of food organisms. The extent of mortality in fishing gear is not well known (estimated to be 2,800 annually by Brooks, 1979). Subsistence harvest of harbor seals is relatively small, probably not exceeding 2,500 animals annually over the entire range (Pitcher, 1984b); however, given the apparent declining trend of this species losses from all of these factors would be expected to require a generation or more for recovery.

Routine air-support activity associated with Federal OCS development may disturb seals on the north side of the Alaska Peninsula near Cold Bay or in the Pribilof Islands (from St. George Basin) and in the northern Kodiak archipelago (from Cook Inlet), but impacts are expected to be minimal and require less than the equivalent of a generation for recovery. Impacts of oil spills (discussed under the base-case scenario) originating from Cook Inlet and Gulf of Alaska lease areas, tankers transporting arctic oil from the TAP, or tankers in the vicinity of Unimak Pass transporting oil from Navarin and St. George Basins are expected to be similar to those described above, requiring one generation or more for recovery. Fuel spills from support vessels that contact seal concentrations, though likely to dissipate quickly, are expected to cause losses requiring a generation for recovery. Impacts from oil-spill-cleanup activities are expected to be as described above, requiring up to a generation for recovery in local areas.

In summary, impact of oil spills from non-OCS oil and gas development on harbor seals in Prince William Sound, the Gulf of Alaska, or Unimak Pass-eastern Aleutian area are expected to result in losses requiring one generation or more for recovery to the original population condition. Spill-cleanup operations are expected to cause local impacts requiring up to a generation for recovery. Impacts of commercial fisheries conflicts, pollution, net mortality, and the subsistence harvest on the seal population are not well known but probably cause losses requiring more than the equivalent of a generation for recovery. Impact of routine disturbance from OCS is expected to require less than one generation for recovery. Impact of oil spills and cleanup activities of OCS origin are expected to be similar to those described for non-OCS sources.

CONCLUSION: Overall cumulative impact on the Alaskan harbor seal population is expected to require five generations or more for recovery during the 24 to 32-year life of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development. For the proposal, impacts are expected to require one to two generations for recovery.

iv. Pacific Walrus

Activities that could produce adverse impacts in the Pacific walrus population include routine and accidental activities associated with offshore oil and gas development, future State of Alaska Beaufort Sea leases, coastal operations associated with Red Dog Mine in the southeastern Chukchi Sea, State of Alaska offshore mining program in Norton Sound, commercial fishing operations, and subsistence and commercial (Russian) harvests.

Routine noise and activity (particularly helicopters and icebreakers) and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Beaufort, Chukchi, and Bering Seas could adversely impact the walrus population. Dredging for pipeline laying may decrease benthic prey availability. Oil spills, the primary accidental factor affecting walruses, are expected to result in sublethal effects if they contact adult walruses or habitats where they may become oiled secondarily; calves are more likely to experience lethal effects than adults. Spill-cleanup operations are expected to cause walruses to temporarily abandon the affected areas; disturbance of herds of females with calves is expected to be especially adverse. Walrus distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

Routine noise and activity and oil spills associated with State oil leases offshore of NPR-A are expected to have minimal impact on the walrus population because this area is at the edge of the summer range, and few individuals would be affected. The Red Dog Mine is expected to have a minimal impact on walruses, because they infrequently occur in the vicinity of its coastal facility. The impact on walruses of offshore mining on State leases, including noise disturbance and disruption of benthic food resources, as well as commercial shellfish harvests, are not expected to require more than one generation for recovery because of the low numbers of individuals affected and the relatively small proportion of available foraging habitat disturbed or prey removed. However, there is evidence of possible depletion of benthic food resources used by the walrus, perhaps caused by the current high population level itself, and these activities are expected to contribute to this situation. The current subsistence and commercial (Russian) harvests apparently are substantial (15,000-20,000/year); their effect on the population is not known but is expected to require one generation or more for recovery. Recent trends in walruses- population characteristics suggest that the population may experience a decline in the foreseeable future.

Recovery from impacts of routine air- and vessel-support activities associated with Federal OCS development are not expected to require more than one generation because of the small proportion of the population likely to be exposed and experience lethal effects and the temporary nature of most effects. Likewise, pipeline dredging operations are not expected to require more than one generation for recovery because only a small proportion of foraging habitat will be disturbed, and disturbance of individual walruses is expected to be minimal. Recovery from impacts of oil spills is not expected to require more than one generation because of the small proportion of the population likely to be contacted and the assumed lack of adult sensitivity to oiling. However, the potential for contact of the same herds by more than one spill (e.g., Navarin Basin in spring, Chukchi Sea in summer) within a relatively short timeframe could elevate the expected recovery period to one generation or more. Impact of oil-spill-cleanup operations, especially if pursued over more than one season, are expected to require up to a generation for recovery.

In summary, the impacts of commercial shellfish harvests on the Pacific walrus are not expected to require more than one generation for recovery; however, they may aggravate the possible depletion of walrus-food resources. The impact of commercial (Russian) and subsistence harvests is expected to require one generation or more for recovery. Recovery from impacts of routine activities associated with OCS oil and gas development is not expected to require more than one generation. Likewise, pipeline dredging is not expected to require more than one generation for recovery. Recovery from impacts of oil spills is not expected to require more than one generation; however, one generation or more is expected in situations where walruses are contacted by more than one spill within a short interval. Impact resulting from oil-spill-cleanup operations is expected to require up to one generation for recovery. An anticipated future decline of the walrus population is expected to extend the required recovery periods resulting from impacting factors.

CONCLUSION: Overall cumulative impact on the Pacific walrus population is expected to require three generations for recovery during the 30-year period of the proposal. Principal components of this impact are OCS oil and gas development and subsistence and commercial harvests. For the proposal, impacts are expected to require up to one generation for recovery.

c) Sea Otter (Alaska Population)

Activities that could produce adverse impacts on the sea otter population in Alaska include routine and accidental activities associated with oil and gas development on current and future State of Alaska leases in Cook Inlet, transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP, transport of oil from the TAP by tanker to Cook Inlet refineries, transport of Cook Inlet production to Far East markets, commercial fishing operations, pollution, and subsistence-harvest activities.

Routine noise and activity and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Gulf of Alaska, Cook Inlet, and the Bering Sea (proposal) could adversely impact the otter population. Oil spills, the primary accidental factor affecting sea otters, are expected to result in lethal effects if they contact otters or habitats where they may become oiled secondarily. Transport of future arctic OCS production from the TAP by tanker represents an additional source of oil spills. Spill-cleanup operations are expected to cause otters to temporarily abandon the affected areas. Sea otter distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

In summary, impact of routine noise and activity associated with State oil and gas leases is expected to be minimal. A tanker spill in Prince William Sound is expected to cause losses requiring two generations or more for recovery. As shown by the *Exxon Valdez* incident, a spill can escape the sound and cause additional losses to the west and south, as could a spill originating on a State lease in Cook Inlet. Likewise, a tanker spill in Unimak Pass is expected to cause substantial losses in the regionally important eastern Aleutian-western Alaska Peninsula otter population, requiring two generations or more for recovery. Disturbance from oil-spill containment and cleanup activities is expected to have a substantial effect on local concentrations of otters, causing abandonment of habitat for a variable period and requiring the equivalent of a generation for recovery to the original population condition.

The impact of the conflict between otters and commercial shellfisheries is not well known and, in fact, otters may interfere with commercial fisheries more than the reverse. Effects of pollution (e.g., Valdez, Seward, Kodiak) other than oil on the otter population are not known, but in such localities pollution may have an adverse effect on food organisms of otters. The extent of mortality in fishing gear is not well known. Subsistence harvest of sea otters is relatively small, probably not exceeding 1,000 animals per year over the entire range; only in the vicinity of villages engaged in this activity would impacts be expected to require a generation or more for recovery.

Routine air-support activity affects harbor seals and sea otters in the same manner.

Impact of oil spills from non-OCS oil and gas development on sea otters in Prince William Sound, the Gulf of Alaska, or Unimak Pass-eastern Aleutian area are expected to result in losses requiring two generations or more for recovery to the original population condition. Spill-cleanup operations are expected to cause local impacts requiring up to a generation for recovery. Impacts of commercial fisheries conflicts, pollution, net mortality, and subsistence harvest on the otter population are not well known but probably do not cause losses requiring more than the equivalent of a generation for recovery. Impact of routine disturbance from OCS activities is expected to require less than one generation for recovery. Impact of oil spills and cleanup activities of OCS origin are expected to be similar to those described for non-OCS sources.

CONCLUSION: Overall cumulative impact on the Alaskan sea otter population is expected to require five generations or more for recovery during the 24 to 32-year life of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development. For the proposal, impacts are expected to require up to three generations for recovery.

d) Polar Bear

Activities that could produce adverse impacts in the polar bear population include routine and accidental activities associated with offshore and onshore oil and gas development on current and future State of Alaska Beaufort Sea leases, oil and gas development on the ANWR, Canadian Beaufort oil and gas development, coastal operations associated with the Red Dog Mine in the southeastern Chukchi Sea, ingestion of toxicants (e.g., antifreeze), and the subsistence harvest.

Routine noise and activity associated with future Federal oil and gas development in the Beaufort and Chukchi Seas (proposal), including aircraft- and vessel-(especially icebreaker) support operations, construction and/or operation of offshore and onshore facilities, seismic-survey activities, construction of causeways and gravel islands, dredging operations, and displacement of seals, could impact the population adversely. Bear-control operations may result in bear mortality. Oil spills, the primary accidental factor affecting polar bears, are expected to result in lethal effects if they contact bears directly, or secondarily from oiled pack ice or contaminated seals. Spill cleanup operations are expected to cause bears to temporarily abandon the affected areas. Polar bear distribution and abundance may be altered if seal availability decreases in the vicinity of an oil spill.

Routine noise and activity associated with offshore and onshore State oil leases, oil development in ANWR, and Canadian Beaufort oil development could displace polar bears from within several kilometers of the sites. Such changes are likely to last for the duration of the activity. Some bears are expected to be attracted to the sites searching for food and may be removed from the population. Displacement of ringed and bearded seals from the offshore sites could result in corresponding changes in polar bear distribution. However, seals also may be attracted in fall to areas of new ice forming in the lee of offshore industrial sites, resulting in bears becoming concentrated and vulnerable to other adverse factors. The most serious consequence of disturbance at industrial sites may be the displacement of pregnant females from preferred denning areas. Although the effects of current development on polar bear denning are not known, dens typically are more sparsely distributed along the Alaskan coast than in other parts of the range. Throughout most of their range, the density of polar bears is extremely low and, because the amount of displacement and change in habitat use is likely to be relatively small in comparison to the natural variability in seasonal habitat use, overall disturbance effects in areas of typical density are expected to result in losses requiring less than one generation for recovery. Where industrial activities cause displacement of females from denning areas, losses could require one generation or more to recover. Potential impacts of oil spills from offshore sites are discussed below.

Coastal operations associated with the Red Dog Mine are expected to have a minimal impact on the polar bear population. Only Natives are allowed to take polar bears in Alaska. Reported take from 1980 - 1985 averaged 135 bears per year; this may represent approximately 21 percent of total mortality (Amstrup and DeMaster, 1988), and is many times the number of bears expected to be affected by oil-spill or disturbance factors. Ingestion of toxicants, known to have caused at least one polar bear death (Amstrup, et al., 1989), is expected to cause minimal losses in the polar bear population requiring less than a generation for recovery.

Impacts of routine noise and activity associated with the proposal are essentially as discussed above and under the base case. It is expected that fewer denning females would be affected by activities farther offshore, although helicopter- support traffic still could cause disturbance when approaching shore facilities. Overall disturbance impacts from these sources are expected to require one generation or less for recovery.

Potential impacts of oil contact with polar bears is discussed under the base case. Contact or ingestion of oil by polar bears is assumed lethal. The low density of polar bears over much of the Arctic during a substantial proportion of the year suggests that relatively few would be contacted by a spill, and thus potential oil-spill impacts on their regional population in such cases are expected to be minimal and require a generation or less for recovery. Where densities are much higher, such as at the southern Beaufort pack-ice edge, in areas of new ice, and in leads, an oil spill potentially could contact substantially greater numbers of bears, resulting in losses requiring a generation or more for recovery to the initial status. Rapid westerly transport in the Beaufort Sea potentially could increase the number of bears contacted by an oil spill moving through large areas where they may be concentrated, thereby delaying the recovery period a generation or more. Most importantly, a relatively large proportion of bears in such habitats may be breeding females, or females with cubs, whose mortality would constitute a greater loss to the population than that of males. If the loss of females the population can sustain is exceeded by other mortality, that resulting from an oil spill could delay population recovery for a generation or more. Oil-spill-cleanup operations are expected to displace bears locally for varying periods (months, or intermittently for several years) depending on spill size, wind and ice conditions, etc. Impacts caused by such activity are expected to require less than a generation for recovery and may be considered favorable if bears are discouraged from approaching an oil spill.

Although extensive annual movements of polar bears have been documented within the two regional population ranges, it is expected that only a very small proportion of the population would be exposed to spills in more than one sale area and thus would minimally extend the recovery period.

In summary, routine and accidental impacts of non-OCS oil and gas development on the polar bear are expected to result in losses requiring more than one generation for recovery to the original population condition. Impact of subsistence harvest is expected to require two generations or more for recovery. Effects of the Red Dog Mine, toxicant consumption, and bear control are expected to be minimal. Routine and accidental impacts of OCS oil and gas development are expected to require two generations or more for recovery and exceed those of non-OCS development.

CONCLUSION: Overall cumulative impact on the Alaskan polar bear population is expected to require five generations or more for recovery during the 24 to 32-year life of the proposal. Principal components of this impact are non-OCS oil and gas development, OCS oil and gas development, and subsistence harvest, in increasing order of severity. For the proposal, impacts are expected to require up to four generations for recovery.

(c) Pacific Region

1) Threatened or Endangered Species

a) Cetaceans

GRAY WHALE: Factors that may produce cumulative effects on gray whales in the Pacific and Alaska Regions include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to gray whales in U.S. waters include increases in municipal and industrial discharges, subsistence hunting, commercial fishing and shipping activities, and Alaskan and foreign-import tankering.

Existing and assumed increases in ocean dumping and discharges of municipal and industrial wastes may eventually have a cumulative effect on the gray whale population, but, to date, the effects of these factors are largely unquantified. As nearshore animals, gray whales may be susceptible to the effects of coastal pollution. Of particular concern are chlorinated hydrocarbons, such as DDT and PCB, and heavy metals.

Since 1967, natives living along the Russian Chukotka coast of the Chukchi Sea have taken an average of 165 gray whales per year in their subsistence hunt (56 *FR* 58872, November 22, 1991). The current catch limit set by the International Whaling Commission is 169 animals per year. This subsistence catch is less than 1 percent of the current estimated gray whale population and is believed to be within the maximum sustainable yield for the species (Reilly, 1984).

In recent years, an unknown number of gray whales have drowned after becoming entangled in gillnets each year. Gill netting was the known cause of death for 1 of 8 gray whales stranded in California in 1983, and for 4 of 21 stranded in 1984. This level of mortality represents the loss of less than 1 percent of the current gray whale population. Recent legislation, including the California Marine Resources Protection Act of 1990, provides for a number of gillnet restrictions and closures from northern California south to the Mexican border. It is expected that these restrictions will substantially reduce gray whale mortality due to incidental take by gillnets.

Migrating gray whales would likely be vulnerable to noise and disturbance from shipping activities. Cumulative industrial disturbance would be greatest in the Pacific Region, especially in areas of heavy traffic such as the Southern California Bight, off San Francisco Bay, and near the Strait of Juan de Fuca, and could result in alterations of migration routes and/or timing.The estimated percentage of gray whales that use offshore routes through the Southern California Bight has increased over the years. The gray whale population has grown steadily in recent decades, and there is no evidence that increased vessel traffic has resulted in any adverse impacts on migrating gray whales.

Noise and disturbance associated with OCS exploratory and development activities in the Alaska and Pacific Regions could combine with disturbance from other sources to increase cumulative impacts. Extensive geophysical exploration has been conducted off the California coast for more than 35 years, yet, as discussed above, the gray whale has recovered to population levels at or above precommercial whaling levels during that same period. This rate of growth and the apparent fitness of the population make it seem unlikely that geophysical exploration has been damaging to the gray whale population. This is apparently also true for other sources of noise and disturbance associated with OCS exploratory and development activities (USDOI, MMS, 1987h). Offshore development associated with the proposed action would constitute a minor portion of the total acoustical stimuli for the gray whale. Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms assumed to be emplaced during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms, and the 7 platforms assumed for the proposed action (base case). Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time. It is also assumed that one pipeline will be constructed to a shoreline landfall in the northern Santa Maria Basin.

In the Alaska Region, there currently are no oil and gas activities in Federal OCS waters, although producing offshore leases do exist in State waters in the Cook Inlet and Beaufort Sea. The cumulative-case scenario for the Alaska Region assumes the existence of 21 platforms in OCS waters over the 30-year life of the proposed action. The number of platform removals expected during this period has not been estimated. Eighteen of these platforms are assumed to be located in the Arctic and Bering Sea Subregions. Five pipeline landfalls are also assumed.

If it is assumed that some whales would avoid areas within 3 km of a platform (an area of about 28 km^2), gray whales would only be excluded from a very small percentage of most planning areas. The numbers of platforms and pipeline landfalls assumed for the cumulative case are not expected to disrupt gray whale migration through the Alaska or Pacific Regions. The exclusion of gray whales from part of their summer feeding grounds could have a greater impact on the population. However, even if all 18 platforms assumed for the Alaskan Arctic and Bering Sea Subregions were sited in the prime gray whale foraging grounds in the Chukchi Sea, gray whales would be excluded from about 500 km^2, or no more than 1.4 percent of the area. The actual number of platforms in this area will almost certainly be lower, and no measurable impacts on the gray whale population are expected.

The emplacement of oil and/or gas pipelines may disturb or degrade some areas of gray whale benthic feeding habitat, and some whales may be excluded from feeding within a few hundred meters of drilling units and production platforms. However, such disturbed areas would likely be a very small percentage of available habitat (see Section IV.D.1.a(3)). Discharges of fluids from drilling units and production platforms are not expected to significantly reduce gray whale food resources.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the gray whale population. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

It is assumed for purposes of analysis that a total of 17 spills (ranging in size from 7,000 to 30,000 bbl) will occur in the Pacific Region over the 35-year life of the proposed action. This total includes 5 TAPS tanker spills, 5 import tanker spills, and 7 OCS spills. The OCS total includes a combination of spills from platforms, pipelines, and the tankering of Alaskan OCS oil. Assuming an uniform distribution of spills, the average number of spills per year from all these sources is approximately 1 spill every 2 years. In the Alaska Region, 23 spills (of 20,000 to 30,000 bbl each) are assumed to occur over a 30-year period. This total includes 6 TAPS tanker spills in the Gulf of Alaska and 17 OCS platform, pipeline, and tanker spills, for an assumed spill number of a little more than 1 spill every 2 years.

Since gray whales migrate through nearly all the planning areas in the Alaska and Pacific Regions, the population could be affected by a number of these spills. Effects on gray whales would be as described for the base-case analysis (Section IV.D.1.a(3)). However, cumulative effects on the gray whale population could be greater, because more spills are expected and more individuals are likely to be contacted. As described in the base case, the gray whale migration is not expected to be disrupted by accidental spills. The greatest effects would be expected if one or more spills were to occur in summer on the gray whale feeding grounds in the Chukchi and Bering Seas, particularly in the important calf-rearing area in the eastern Chukchi Sea. Fourteen oil spills 1,000 bbl or greater are assumed to occur in the Arctic and Bering Sea Subregions for the cumulative case. Assuming occurrence and contact, it is expected that a few individuals may be killed and that whales may be displaced from areas of up to 1,500 km^2 for all or part of a season.

For the Pacific Region, it is assumed in the cumulative case that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). In the Alaska Region, it is assumed that as many as 1,938 oil spills of 1-50 bbl and 79 spills of 50-999 bbl will occur over the life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are not expected to make a measurable contribution to impacts on the gray whale population.

CONCLUSION: The gray whale population is expected to continue to increase over the life of the proposed action. The cumulative effects of the discharge of municipal and industrial wastes on gray whales are presently unknown. Subsistence hunting, commercial fishing, and shipping activities are expected to have a minor impact on the gray whale population. Disturbance associated with routine

OCS activities, including the proposed action, are also expected to have a minor effect on migrating gray whales. The major impacting factor is expected to be spilled oil. The cumulative impacts of accidental oil spills (both non-OCS and OCS-related) are expected to cause the death of a few individual gray whales on their Alaskan feeding grounds, but no changes in numbers or distribution distinguishable from multi-year natural variation in the gray whale population are anticipated.

b) Pinnipeds

GUADALUPE FUR SEAL: Activities that could conceivably have cumulative effects on Guadalupe fur seals include commercial fishing operations in U.S. and Mexican waters and the transportation of both OCS and non-OCS oil.

In California, set and driftnet fisheries for halibut and other finfish have been an important cause of marine mammal mortality in recent years, and, despite their low numbers in the area, it is probable that a few Guadalupe fur seals have also been taken in this way. Recent legislation, provides for a number of gillnet restrictions and closures from northern California south to the Mexican border. It is expected that these restrictions will substantially reduce possible fur seal mortality due to incidental take.

The impacts of commercial fishing in the waters adjacent to the species' only rookery on Isla de Guadalupe are unknown. The small breeding population on the island would be most vulnerable during the summer, when lactating females are foraging off the rookery.

The very low densities of Guadalupe fur seals estimated to occur in southern California waters make it unlikely that more than a few individuals would be contacted and killed by an accidental oil spill. Such a low level of mortality would be indistinguishable from natural variation in the fur seal population and is not expected to impede the species' recovery. This could change if the population continues to grow and to appear in California waters with greater frequency. However, based on what is known of the species' current numbers and distribution, accidental oil spills are not expected to have a cumulative impact on the Guadalupe fur seal population over the 35-year life of the proposed action.

CONCLUSION: The Guadalupe fur seal population is expected to continue to grow. At this stage of the species' recovery, non-OCS and OCS activities in the Pacific Region are not expected to have cumulative impacts on the population during the life of the proposed action.

c) Sea Otter (Pacific Population)

The principal sources of cumulative effects to the Pacific Region sea otter population are commercial gill and trammel-net fishing operations, agricultural runoff and municipal and industrial discharges, and the tankering of Alaskan and imported foreign oil, and assumed OCS oil spills.

The incidental drowning of California sea otters in gill and trammel nets is believed to have been a significant source of mortality in the 1970's and early 1980's. A series of set-net restrictions and closures in the mid-1980's prohibited gill and trammel nets inside the 20-fathom isobath over much of the sea otter's central California range and apparently reduced mortality due to incidental take. Recent legislation extends this protection by providing for a ban on gillnets and trammel nets within 3 miles of the California coast from Point Arguello to the Mexican border and for 1 mile or 70 fathoms, whichever is less, around the Channel Islands, plus a ban on rockfish gillnets in all areas, even outside the 3-mile and 1-mile zones.

The northern limit of the present Washington sea otter population is already at the southern boundary of the Makah tribal set-net fishery operating out of Neah Bay. Although there have apparently been no reports of sea otter deaths due to entanglement in these nets, the potential for such mortality will exist if the otters extend their range northward.

As nearshore animals, sea otters may be susceptible to the effects of coastal pollution. The Washington sea otter population inhabits a rugged, isolated stretch of northern Washington coastline, where water quality appears to be excellent (see Section III.C.1.c). Most of the California sea otter range has very low concentrations of environmental pollutants. Agricultural runoff and the discharge of municipal and industrial wastes appear to be the primary sources of contaminants within the sea otter range. High concentrations of pesticides enter Monterey Bay with agricultural runoff from the Salinas and Pajaro Valleys. Municipal and industrial wastes are discharged from several communities in Monterey and Morro Bay.

Adverse effects on sea otters from environmental contaminants have not been documented, although variable residue levels of a number of polychlorinated biphenyls (PCB's), chlorinated hydrocarbons, and heavy metals have been found in tissue samples. Residue levels of these contaminants in sea otter tissues have generally been well below levels known to cause debilitation or mortality, although PCB residues in a number of liver samples were higher than levels known to cause reproductive failure in mink. However, birth rates among California sea otters appear to be comparable to those observed in Alaska, and the population seems thus far unaffected.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the California sea otter population. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, assumed, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case for the Pacific Region have been described earlier under Section IV.D.1.c(1). That description includes assumptions regarding oil spill occurrence, source, and size.

Eleven of these spills (7,000 to 30,000 bbl) are assumed to occur in the Central and Southern California Planning Areas and thus could contact the mainland sea otter range or the translocated population on San Nicolas Island. Interpolating from the Ford and Bonnell (1987) model cited in Section IV.D.1.a(3), it would be likely to oil approximately 30 to 60 kilometers of coastline. If the length of coastline affected by such a spill stretched northward 60 km from the Santa Maria River, it would extend approximately as far as Cayucos at the north end of Estero Bay.

Approximately 430 sea otters, or about 22 percent of the current California population, are found along the stretch of coast from Estero Bay to the Santa Maria River mouth (R. Jameson, FWS, pers. comm., December 19, 1991a); a few animals also occur between the river and Point Conception. As discussed for the base case, an oil spill occurring in this area would present a serious threat to those otters. Some mortality and the loss of a portion of the sea otter range for a period of several months or more would be expected. It is unlikely that all sea otters in this area would die as a result of the spill, but recovery from the loss of 22 percent of the population would take 4 to 5 years at an annual growth rate of 5-7 percent (USDOI, FWS, 1991a).

If an assumed spill occurred south of the northern Channel Island chain and contacted the south side of San Nicolas Island, the small colony of translocated sea otters (less than 20 animals) would probably be eliminated as a viable population.

In 1986, the FWS completed a formal endangered species consultation on a hypothetical areawide proposal for offshore oil and gas development and production associated with the San Miguel Project (Platform Julius) in the northern Santa Maria Basin (USDOI, FWS, 1986). The hypothetical proposal provided for the development of up to seven platforms and a single pipeline to a landfall approximately 1 km north of the Santa Maria River.

It was the biological opinion of the FWS that this hypothesized development was likely to jeopardize the continued existence of the California population of the southern sea otter. This opinion was based on the additional increment of oil spill risk associated with the hypothetical development scenario added to the existing oil spill risk from ongoing tankering and prior oil/gas development. Tankering activities were estimated to contribute 97 percent of the risk to sea otters. Oil and gas development for which consultation had already been concluded contributed the remaining 3 percent. Although the hypothetical development in the northern Santa Maria Basin was projected to increase the overall oil spill risk to the sea otter population by 8 percent, all this risk would have been located in the southern part of the range. It was projected that the combined effect of spills assumed to occur from tanker traffic and OCS development activity would result in the loss of 200 or more adult female otters (about 60 percent of the breeding females in the population at that time). The FWS termed such a loss unacceptable and stated that the risk was exacerbated when combining the effects of the hypothetical full development on the expanded population. The sea otter translocation program, which was not implemented at the time the opinion was written, was not considered in their analysis.

Since the FWS issued its jeopardy opinion in 1986, the California sea otter population has increased by nearly 25 percent, and, as described above, the threat of mortality from commercial fishing activities has been substantially reduced. None of the development hypothesized for the northern Santa Maria Basin has occurred.

In addition, the projected impacts cited in the FWS opinion resulted from the combined effect of tanker spills occurring in the northern half of the sea otter range and spills from oil and gas development occurring in the southern half of the range. However, as discussed above, it is assumed for the cumulative analysis that spills will occur with uniform frequency and spatial distribution over the 35-year period of the proposal. Therefore, it is assumed that spills will not occur simultaneously, and combined effects of the type described in the FWS opinion are not expected.

If a large tanker spill were to contact the sea otter range, the population could be severely affected, although, as discussed for the base case, the sea otter cleaning facility and program required by recent California legislation (S.B. 2040) are expected to afford the mainland California sea otter population greater protection from the effects of oil spills. Additional mitigation, such as shifting tanker lanes farther offshore, might also be required.

Four tanker spills are assumed to occur off the Washington coast in the cumulative scenario. If such a spill were to reach the shoreline and contact the Washington sea otter range, it is expected that tens of otters would be killed and a portion of the range rendered uninhabitable for a period of several months or more. Given its present small size (about 200 animals), the existence of the population could be threatened by such a spill, and recovery is expected to take up to 6 years.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the 35-year life of the proposed action (see Table IV.D.1.c-6). These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are not expected to make a measurable contribution to impacts on the California sea otter population.

CONCLUSION: The California and Washington sea otter populations are expected to continue to grow. The fate of the small translocated sea otter population on San Nicolas Island is uncertain. The greatest cumulative effects on the Pacific sea otter populations are expected from accidental oil spills resulting from the transportation of both OCS and non-OCS oil. The proposal is assumed to contribute two tanker spills and one pipeline spill to the overall total of 15 oil spills assumed to occur in planning areas of the Pacific Region occupied by sea otters. Based on the assumption that sea otters would be exposed to two of the 15 assumed spills, the activities related to the proposal (i.e, one assumed pipeline spill) are expected to contribute up to half of the expected impact; the remaining spill impacts are likely to result from a non-OCS tanker spill. The effects of a single spill contacting the sea otter population would include sea otter mortality, the loss of a portion of the habitat for several months or more, and a population recovery period of at least 4 years.

2) Nonendangered Species

a) Cetaceans

i. Killer Whale

Factors that may produce cumulative effects on killer whales in the Pacific and Alaska Regions include both non-OCS and OCS-related activities. Possible sources of non-OCS-related impacts to killer whales include commercial fisheries conflicts, municipal and industrial discharges, and Alaskan and foreign-import tankering.

In Alaska, conflicts have occurred between killer whales and commercial long-line blackcod and halibut fisheries in Prince William Sound and the Bering Sea. Killer whales steal fish from lines and damage gear. In response, fishermen have used high-power explosives to frighten whales away from gear and have occasionally shot killer whales. Killer whale mortality from these activities is known to have occurred in Prince William Sound and is suspected to have occurred in the Bering Sea. The level of this mortality and its effect on Alaskan killer whale populations is unknown.

Resident populations of killer whales, particularly those inhabiting inland waters in the vicinity of Puget Sound, may be susceptible to the effects of coastal pollution. Existing and assumed increases in discharges of municipal and industrial wastes may eventually have a cumulative effect on some killer whale populations, but, to date, the effects of these factors are largely unquantified.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the killer whale population. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed program. The third source includes the transport of oil produced by existing, assumed, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case for the Pacific Region have been described earlier under Section IV.D.c(3), Threatened and Endangered Cetaceans . That description includes assumptions regarding oil spill occurrence, source, and size.

Killer whales occur in nearly all the planning areas in the Alaska and Pacific Regions, the population could be contacted by a number of these assumed oil spills. However, as discussed in Section IV.D.1.a(3), killer whales are not expected to be at great risk from oil spills. No mortality is expected as a result of accidental oil spills; changes in killer whale numbers and distribution in areas contacted by a spill are expected to last less than 1 year.

The cumulative-case scenario for the Pacific Region, assumes that 116 oil spills of 1-50 bbl and 4 spills of 51 to 999 bbl will occur over the 35-year life of the proposed action (see Table IV.D.1.c-6). In the Alaska Region, it is assumed that as many as 1,938 oil spills of 1 to 50 bbl and 79 spills of 50 to 999 bbl will occur over the 30-year life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are not expected to make a measurable contribution to impacts on the killer whale population.

CONCLUSION: Although the size of the killer whale population in the eastern North Pacific is unknown, the species occurs throughout most of the Alaska and Pacific Regions, and numbers appear to be increasing in at least a few areas. Some fisheries-related mortality is occurring in Alaska, but its effect on local populations is unknown. The cumulative effects of the discharge of municipal and industrial wastes on killer whales are also presently unknown. None of the other possible impacting factors identified, including both OCS and non-OCS activities, are expected to have effects on killer whales that are distinguishable from natural variability in the species' population in the Alaska and Pacific Regions.

ii. Harbor Porpoise

Factors that may produce cumulative effects on harbor porpoises in the Pacific and Alaska Regions include both non-OCS and OCS-related activities. Major sources of possible non-OCS oil and gas cumulative impacts to harbor porpoises include commercial fishing operations, increases in municipal and industrial discharges, commercial shipping activities, and Alaskan and foreign-import tankering.

Harbor porpoises are caught and killed incidently in substantial numbers by U.S. and Canadian fisheries along the west coast. Recent legislation provides for a number of gillnet restrictions and closures from northern California south to the Mexican border. It is expected that these restrictions will substantially reduce harbor porpoise mortality due to incidental take at the southern end of its range.

As nearshore animals, harbor porpoises are probably susceptible to the effects of coastal pollution. Existing and assumed increases in discharges of municipal and industrial wastes may eventually have a cumulative effect on the harbor porpoise population, but, to date, the effects of these factors are largely unquantified. Since harbor porpoises are rare south of Point Conception, they are not exposed to the higher levels of contaminants found in Southern California Bight waters.

Harbor porpoises are believed to avoid vessels, and increased boat traffic is thought to have contributed to recent harbor porpoise population declines in southern Puget Sound.

In the Pacific Region, the vessel traffic associated with the proposed action is assumed to occur in the Santa Barbara Channel and Santa Maria Basin, at or near the southern end of the species' range. OCS activities in the Cook Inlet and Gulf of Alaska are the most likely to impact harbor porpoises in the Alaska Region. However, the proposed action in these areas is assumed to be relatively minor, involving the construction of only three platforms and associated traffic. These activities are not expected to add measurably to the cumulative impact on the harbor porpoise population.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the harbor porpoise population. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under (Section IV.D.1.c(3)), Pacific Marine Mammals, Threatened and Endangered Cetaceans . That description includes assumptions regarding oil spill occurrence, source, and size.

Harbor porpoises occur in nearly all the planning areas in the Alaska and Pacific Regions, the population could be affected by a number of these spills. Effects on harbor porpoises would be as described for the base case (Section IV.D.1.a(3)). However, cumulative effects on the harbor porpoise population could be greater, because more spills are expected and more individuals are likely to be contacted. As described in the proposal, if such a spill were to occur and contact nearshore waters, it would be expected to result in the loss of a few individuals and the disturbance or displacement of harbor porpoises from the area of the spill for a period of several months.

The cumulative-case scenario for the Pacific Region, assumes that 116 oil spills of 1-50 bbl and 4 spills of 51 to 999 bbl will occur over the 35-year life of the proposed action (see Table IV.D.1.c-6). In the Alaska Region, it is assumed that as many as 1,938 oil spills of 1 to 50 bbl and 79 spills of 50 to 999 bbl will occur over the life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are not expected to make a measurable contribution to impacts on the harbor porpoise population.

CONCLUSION: Surveys of harbor porpoises have only recently begun. It is currently unknown whether the harbor porpoises population in the eastern North Pacific is declining, stable, or growing. Incidental take by commercial fisheries has been an important source of harbor porpoise mortality, although this may be decreasing as the result of recent legislation. The cumulative effects of the discharge of municipal and industrial wastes on harbor porpoises are presently unknown. Although disturbance from vessel traffic is believed to have contributed to a harbor porpoise decline in at least one area, routine activities from the proposed action are not expected to add measurably to the cumulative impact on the harbor porpoise population. Accidental oil spills associated with the transportation of OCS and non-OCS oil are expected to result in the death of a few individuals and the temporary loss of habitat, but are not anticipated to be a primary impacting agent.

b) Pinnipeds

i. Northern Elephant Seal

Factors that may produce cumulative effects on northern elephant seals in the Pacific and Alaska Regions include both non-OCS and OCS-related activities. The major source of non-OCS-related cumulative impacts to northern elephant seals is Alaskan and foreign-import tankering.

Like California sea lions, northern elephant seals appear to be relatively unaffected by anything occurring in their environment thus far. They are most vulnerable to disturbance and the effects of oil spills when hauled out in the winter on the rookeries (and, to a lesser extent, during the spring and summer molt haulout). At sea, elephant seals are pelagic, feeding at great depths and spending little time at the surface (Section III.C.2), and are less vulnerable to potential impacting agents (Section IV.D.1.a(3)).

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the northern elephant seal population. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, assumed, and proposed OCS activities in the Alaska and Pacific Regions.

It is assumed for the cumulative case that a total of 17 spills (ranging in size from 7,000 to 30,000 bbl) will occur in the Pacific Region over the 35-year life of the proposed action (see Table IV.D.1.c-4). This total assumes 5 TAPS tanker spills, 5 import tanker spills, and 7 OCS spills. The OCS total assumes a combination of spills from platforms, pipelines, and the tankering of Alaskan OCS oil. Assuming an uniform distribution of spills, the average number of spills per year from all sources is approximately 1 spill every 2 years.

The major elephant seal rookeries north of Mexican waters are on San Miguel and San Nicolas Islands off southern California and at Año Nuevo Island and Point on the central California coast. If a major oil spill were to contact one of the rookery islands during the species' winter breeding season, minor pup mortality might occur directly as the result of oiling. However, disturbance of animals on rookery beaches in the course of cleanup activities would be a greater threat, since the separation of elephant seal cows from pups generally leads to the death of the pups. As discussed in the base case, an accidental oil spill is expected to result in the death of a few northern elephant seal pups (probably 20 or less). This is less than 1 percent of the current annual elephant seal pup production on U.S. rookeries.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51 to 999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6.). These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are not expected to make a measurable contribution to impacts on the northern elephant seal population.

CONCLUSION: The northern elephant seal population is expected to continue to grow over the life of the proposed action. Although minor mortality (less than 1 percent of the annual pup production in southern California) is expected due to accidental oil spills resulting from the transportation of OCS and non-OCS oil, none of the impacting factors identified are anticipated to have measurable effects on the northern elephant seal population.

ii. California Sea Lion

Factors that may produce cumulative effects on California sea lions in the Pacific and Alaska Regions include both non-OCS and OCS-related activities. Possible sources of non-OCS oil and gas-related cumulative impacts to California sea lions include commercial fishing operations, increases in municipal and industrial discharges, and Alaskan and foreign-import tankering.

Conflicts with commercial fisheries activities can impact California sea lions in several ways: indirectly, through reduction of sea lion prey populations; and directly, through accidental entanglement in fishing gear and debris or shooting or harassing. California sea lions are among the species of pinnipeds known to have become entangled in commercial fishing nets and floating marine debris. In central California, sea lions have been taken incidental to gill and trammel net fishing operations most often in Monterey Bay. This level of incidental take does not appear to present a threat to the sea lion population off California.

California sea lions are primarily coastal animals and are probably susceptible to the effects of coastal pollution. Organic pollutants are known to cause reproductive failure in harbor seals. Existing and assumed increases in discharges of municipal and industrial wastes may eventually have a cumulative effect on California sea lions, but, to date, the effects of these factors are largely unquantified.

Cumulative disturbance from noise associated with existing and assumed State and Federal OCS activities could affect California sea lions, although continued habituation to such disturbance is probable. California sea lions are common around California production platforms and harbor breakwaters, and there is no reason to expect that they would be adversely affected by the level of routine noise associated with the proposed action. Increasing harassment of California sea lions on their rookeries (particularly by helicopter traffic) would likely cause the greatest impacts to the population. However, the northernmost established California sea lion rookery is currently on San Miguel Island, south of the Santa Barbara Channel, and it is unlikely that OCS helicopter traffic would be routed over existing rookeries.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the California sea lion population. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

Analysis of oil spill risks from existing leasing and tankering and the proposal generally shows an increase from the proposal alone in spill probabilities for important areas utilized by California sea lions. If OCS oil and gas development occurs in both the Pacific and Alaskan planning areas, California sea lions could be subject to increased oil spill risks along their migratory pathway, from southern California as far north as British Columbia. Cumulative effects on California sea lions due to an oil spill may be greatest at locations downcurrent of the proposed sale area and where tanker traffic occurs (e.g., San Miguel and San Nicolas Islands).

California sea lions were apparently little affected by the 1969 Santa Barbara Channel oil spill which occurred in the winter, outside the species' breeding season. A higher level of impacts, possibly including the death of tens to hundreds of pups, would be expected if an oil spill were to occur and contact a rookery island, such as San Miguel Island, during the species' summer breeding season (see Section IV.D.1.a(3)). Cumulative effects on the California sea lion population could be greater, because more spills are expected and more individuals are likely to be contacted.

The cumulative-case scenario for the Pacific Region, assumes that 116 oil spills of 1-50 bbl and 4 spills of 51 to 999 bbl will occur over the 35-year life of the proposed action (see Table IV.D.1.c-6). These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are not expected to make a measurable contribution to impacts on the California sea lion population.

CONCLUSION: Despite increases in potentially adverse effects, the California sea lion population has been growing steadily in recent decades and is apparently little affected by anything occurring thus far in its environment. The cumulative effects of the discharge of municipal and industrial wastes on California sea lions are presently unknown. The population is expected to continue to grow during the 30- to 35-year life of the proposed action, despite minor mortality (less than 5 percent of the annual pup production in southern California) due to accidental oil spills resulting from the transportation of non-OCS and OCS oil. Two of the three large oil spills assumed to occur off southern California for the cumulative case result from the proposed action.

(d) Atlantic Region

1) Threatened or Endangered Species

a) Cetaceans

The cumulative-case scenario assumptions for routine oil and gas activities and infrastructure are similar to those of Section IV.D.1.b. Nine platforms will be sited on the mid- and south Atlantic OCS. The major hydrocarbon recovered is natural gas which is transported to 4 onshore locations by 1,150 km (700 mi) of pipeline. Platform activities are supported by vessel and helicopter operations based out of 2 existing shore facilities and 2 existing heliports.

Impact producing activities and agents which may affect endangered cetacean populations may originate from several sources. These are non-OCS activities, routine OCS gas and oil activities, and accidents associated with non-OCS and OCS gas and oil operations. Non-OCS impact producing factors include collisions with vessels and vessel harassment, entanglement in commercial fishing gear, competition with commercial fisheries for biological resources, and chemical pollutants. Due to the current levels and expected continuance of hydrocarbon importation, accidental spills of imported hydrocarbons may also occur which are not associated with OCS gas and oil activities. Routine OCS activities which may impact endangered whales include underwater noise, muds and cuttings discharges, the physical presence of platforms and other offshore stationary structures, aircraft and vessel operations, and geophysical surveys. Accidental events associated with OCS gas and oil operations center on the accidental discharge of hydrocarbons.

The existing conditions of the endangered cetaceans which occur on the Atlantic OCS are described in Sections III.D.2.a and IV.D.1.a. Non-OCS gas and oil activities continue to impact endangered whale populations both directly and indirectly. Collisions with vessels represent the primary source of potential lethal impacts. Species which are particularly vulnerable include the right whale and humpback whale. Non-OCS vessel traffic which could also impact whales includes military and commercial shipping, fishing vessels, and a growing number of recreational craft. Aircraft-induced startle reactions due to private, military, and commercial flights are another source of potential impacts on endangered cetaceans. Entanglement in fishing gear can also result in lethal and debilitating impacts to whales. Again, the more susceptible species among endangered cetaceans are right and humpback whales. In addition to entanglement, commercial fishing activities may also be affecting endangered cetacean populations by direct competition and by physical alteration of habitat, in particular the community structure of whale feeding grounds. Chemical pollutants are known to contaminate whale tissues and persistent debris also affects cetaceans. Even whalewatching, a substantial ecotourism industry in north Atlantic waters, has come under scrutiny as a potential source of impacts to these animals.

Potential impact-producing factors associated with routine gas and oil operations include noise, vessel and aircraft traffic, geophysical surveys, offshore structures, muds and cuttings discharges, and pipeline installation. Other than accidental collisions between tankers or support vessels and whales, routine potential impact-producing factors are considered sublethal. Although some activities are short-term, others have a duration to 30 years. Discussions of routine potential impact-producing factors are given below.

This scenario assumes 23 chronic operational discharges of refined hydrocarbons (1 to 50 bbl), an assumption which is quite close to the base case 20 operational spills. In addition, 1 accidental discharge between 50 bbl and 1,000 bbl is assumed. Impacts associated with these small spills are expected to be similar to those expected for the base case (see Section IV.D.1.a(3)). No locations for either chronic operational spills or small oil spills are specified, but it is expected that most of these accidental spills will occur offshore. The number, size, and location of oil spills have been discussed previously. All are assumed attributable to tanker transport of imported oil. No spills are assumed for the north Atlantic or the Straits of Florida, nor will routine OCS gas and oil industry activities affect any endangered cetaceans within these areas.

Due to the similarities between the routine activities of the cumulative and high case scenario, the level of impacts are expected to be largely the same as those identified for Section IV.D.1.b(3).

Drilling activities will be the most prevalent noise source associated with the cumulative scenario. Fifty exploration and delineation wells will be followed by 160 development and production wells. The combined noise of drilling operations, and platform machinery, combined with vessel and helicopter traffic may result in occasional episodes of temporary avoidance of the immediate area surrounding offshore platforms. Based on observations of interactions between whales and gas/oil activities in other OCS regions, the presence of 9 platforms on the mid- and south Atlantic OCS is not expected to measurably affect endangered whale populations.

Due to the limited seasonal occurrence of endangered baleen whales on the mid- and south Atlantic, it is not expected that OCS gas and oil vessel traffic will result in the death or injury of endangered whales. With the possible exception of the right whale, the death of a very few individuals over the 30-year timeframe of this scenario is not expected to result in measurable impacts on the affected population(s).

The level of geophysical survey activities cannot be identified at this time. However, this activity is not expected to produce measurable impacts on endangered whales.

Helicopter traffic will likely result in occasional startle responses among individuals or small groups of migratory or resident whales. These impacts are sublethal and not expected to result in measurable impacts on the affected populations.

The volume of muds and cuttings discharged in the cumulative scenario are equal to the discharge levels of the high case scenario (2.3 Mbbl of muds and 0.9 Mbbl of cuttings) and are expected to have a negligible impact on endangered whales.

Pipeline infrastructure and landfalls are the same as those in Section IV.D.1.b(3). Impact conclusions for the cumulative-case scenario are therefore not expected to differ from those in Section IV.D.1.b, or to differ substantially from the impact assessment in Section IV.D.1.a(3). No measurable changes in population size, distribution, or behavior among populations of endangered cetaceans on the Atlantic OCS are expected due to pipeline construction.

Along with the expected impacts associated with routine activities, endangered cetaceans would continue to be subject to non-OCS sources of impacts. For the most part these are sublethal. Examples include startle reactions and more biologically ominous impacts due to pollutants and habitat modification. Other impacts which could foreseeably continue over the 30-year duration of the proposed action are lethal or debilitating. Foremost among these are collisions with vessels and the injuries or drowning which may occur when whales become entangled in active or discarded fishing gear. The species most sensitive to these impacts is the right whale.

The 23 chronic operational discharges assumed are not expected to measurably affect endangered cetacean populations due to the rapid dispersal and evaporation of spilled materials (see Sections IV.D.1.a and IV.D.1.b). Impacts due to contact with oil, as might occur during the single small spill (greater than 50 and less than 1,000 bbl) assumed in the cumulative scenario are described in the discussion of an oil spill greater than or equal to 1,000 bbl (Sections IV.A, IV.D.1.a(3), and IV.D.1.b(3)).

The number, size, and location of oil spills have been discussed previously. No spills in port waters are likely to affect populations of endangered cetaceans as these animals do not occur with any predictable frequency in inshore waters.

It is likely that some individual whales will be contacted by 1 or more of the offshore spills. Discussions of potential impacts are in Sections IV.A., IV.D.1.a(3) and IV.D.1.b(3). Although the number of oil spills are expanded under the cumulative scenario, thus increasing the likelihood of contacting endangered cetaceans, no measurable impacts on endangered whale populations are expected. South of Cape Hatteras, where at least a few of the 9 offshore spills are likely to occur, it appears that species such as the humpback whale leave the OCS for deep waters in their annual migrations to the West Indies. Thus portions of the mid- and south Atlantic OCS may not be routinely frequented by certain endangered cetaceans, reducing their opportunities for impacts due to at least some of the assumed spills.

A small portion of the right whale population does migrate inshore and overwinters in the coastal waters offshore Georgia and Florida. With only one spill occurring offshore on the south Atlantic OCS, it is not expected to result in measurable impacts on whale populations in general, and right whales in particular.

Fin whales may occur anywhere on the Atlantic OCS but during the winter months they are generally distributed from the Delmarva Peninsula south to Florida. This species could be contacted by spilled oil in the mid- and south Atlantic. However, as discussed in the base case (Section IV.D.1.a(3)), this species has been observed in contaminated waters and does not appear to be noticeably affected by the presence of oil.

Bioaccumulative impacts due to oil ingestion are not expected to occur to endangered balaenopterids (baleen whales) because these species do not feed outside of New England waters. The sperm whale is not a surface feeder and its prey occurs deep in the water column, making ingestion-related impacts unlikely.

Even in the absence of special protections, it is not expected that measurable impacts on endangered and threatened cetaceans will occur under the cumulative scenario. No unusual, rare, or uncommon ecosystems on which endangered or threatened cetaceans are specifically dependent, occur at or closely adjacent to areas proposed for possible leasing. With the exception of the sperm whale which inhabits the mid- and south Atlantic OCS year-round, endangered cetaceans occur within potential lease areas on the Atlantic OCS only on a seasonal basis. Potentially critical habitats, such as the north Atlantic feeding grounds or the Florida-Georgia right whale calving area, are not expected to experience impacts from routine activities or accidents under the cumulative scenario.

In summary, the endangered status of the right, humpback, fin sei, blue and sperm whales is a direct consequence of earlier overharvesting. With the exception of the right whale, the remaining species which routinely occur on the Atlantic OCS do not appear to be in any imminent or foreseeable danger of extinction. Several human activities, not associated with gas and oil activities, continue to affect whale populations. Routine gas and oil activities as described in the base case would contribute very slightly to the potential for lethal and sublethal whale-vessel collisions. However, unlike other vessels operating on the Atlantic OCS, those involved in the gas and oil industry are required to follow Notice to Lessee guidelines intended to reduce their potential to impact endangered cetaceans. These measures effectively reduce the potential of collisions to negligible levels. The remaining potential sources of impacts are sublethal. Therefore, the remaining routine potential impact-producing factors, described above, are not expected to produce any measurable changes in the distribution, population size, or behavior of endangered cetacean populations. For reasons discussed in all scenarios, the assumed oil spills are not expected to result in measurable impacts to endangered cetacean populations on the Atlantic OCS.

CONCLUSION: Routine activities and accidents associated with the cumulative scenario, and those which are not related to gas and oil operations, are not expected to result in measurable changes to the population size, distribution, and behavior of the endangered cetacean populations occurring on the Atlantic OCS.

2) Sirenians

Impact producing activities and agents which may affect the endangered West Indian manatee under this section may originate from three sources. These are non-OCS activities, routine OCS gas and oil activities, and accidents associated with OCS gas and oil operations. Non-OCS impact producing factors include collisions with vessel and barge traffic, entanglement in fishing gear, habitat losses, and chemical pollutants. Routine OCS activities which may impact endangered manatees are limited to inshore activities. These include possible collisions with support vessel traffic, startle reactions due to both vessel and aircraft traffic, and pipeline emplacement. Accidental events associated with OCS gas and oil operations center on the accidental discharge of hydrocarbons. Because of the habitat preferences of this species it is unlikely that any spilled hydrocarbons which remain offshore would contact this resource. The major sources of non-OCS impact on this species are fatal or sublethal collisions with vessel and barge traffic. Collisions with recreational boats are common as are incidents of manatees drowning in flood control gates. Animals have been reportedly injured by discarded fishing line. Extensive development has resulted in substantial losses of manatee habitat. Lowered water quality and various types of pollution have also affected this species. This has been a major factor contributing to the decline in this species' population.

Due to the similarities between the cumulative and high case scenarios with respect to routine activities, the level of impacts expected due to routine operations are essentially the same as those identified in Section IV.D.1.b.

Because of the restricted distribution of the West Indian manatee and its preference for sheltered coastal and riverine habitat, it is not expected that routine gas and oil activities considered under the cumulative scenario will affect the Atlantic coast population. However, the occasional migratory individual could contact gas and oil activities elsewhere along the mid- and south Atlantic coast. These individuals would be potentially subject to collisions with vessels, sublethal and short-term startle reactions caused by vessel or helicopter traffic, or disturbance due to pipeline construction. Sublethal impacts to these occasional migrants would have a negligible effect on the manatee population of Florida. Were a very few individuals to be killed by oil and gas vessel or barge traffic, it is not expected that this would result in a measurable change in the population size, distribution, or behavior of the resident Florida population.

Although manatees are not expected to be affected by gas and oil activities on the mid- and south Atlantic OCS, this species would continue to be subject to non-OCS sources of impacts. Fatal or sublethal impacts due to collisions with vessels, barges, and recreational craft will likely continue as will drowning due to entrapment or entanglement. Habitat loss continues to be a significant component of the overall problem of effecting recovery efforts. Sublethal impacts such as accumulation of foreign chemicals and harassment by humans will also be expected to continue over the 30-year duration of the proposed action.

For a description of the assumed accidents in the cumulative scenario, see the discussion of this topic given for cetaceans. Offshore operations including accidents are not expected to affect manatees due to the distance of these activities from potential manatee habitat.

Although not expected, chronic operational spills of hydrocarbon in inland waters; or, more likely, at a vessel support facility could contact migrating individuals.

Under the cumulative scenario, 9 oil spills 1,000 bbl or greater are assumed to occur offshore. These spills will not affect manatees. Four additional spills are also assumed to occur within ports. Since all assumed spills are related to the tanker transport of imported hydrocarbons, no impacts due to an OCS-related oil spill are expected on manatees.

Under the cumulative scenario, it is not expected that manatees would be contacted or affected by a spill occurring offshore or at ports. However, manatees could be contacted were an oil spill, due to a tanker accident, to occur within coastal waters of Florida and enter potential manatee habitat such as lagoons or bays. Although considered highly unlikely as a potential accident scenario, individuals exposed to freshly spilled oil in confined waters from which they could not escape could be affected quite severely. Prolonged contact with spilled hydrocarbons under these conditions, including inhalation of volatile fractions, could result in serious injuries or death. Collateral damage to habitat, in particular vegetation, could result in unknown indirect impacts to animals in the affected area.

The restricted distribution and habitat preferences of the majority of the manatee population make contact with routine inshore gas and oil activities improbable. An occasional migrating individual could occupy or transit waters at or near marine support facilities, thereby becoming potentially subject to sublethal impacts due to helicopter and vessel traffic and chronic operational discharges. A very limited potential exists for fatal impacts due to vessel-manatee collisions over the 30-year cumulative scenario. In the event that manatees were contacted by spilled oil, it is believed that direct impacts will be similar to those expected for cetaceans. Oiling of critical habitat, particularly riverine areas, is not expected.

CONCLUSION: Routine and accidental events and non-gas/oil activities considered in the OCS and non-OCS cumulative scenario are not expected to measurably affect the distribution, behavior, or population of the West Indian manatee.

2) Nonendangered Species

CETACEANS: Impact producing factors which could affect nonendangered and nonthreatened cetaceans are non-OCS activities, routine OCS gas and oil operations, and accidents which occur during OCS gas and oil activities. Non-OCS impact producing factors include entanglement in fishing gear, competition with fisheries efforts, inshore habitat deterioration, and chemical pollutants. Routine OCS gas and oil activities which may impact nonendangered and nonthreatened cetaceans include underwater noise, mud and cuttings discharges, the physical presence of platforms and other offshore structures, aircraft and vessel operations, and geophysical surveys. Accidental events associated with OCS gas and oil operations include chronic operational discharges of hydrocarbons and oil spills. Oil spills not associated with OCS operations may also occur due to tanker transportation of imported oil and products.

Non-gas and oil related impacts on these populations include chronic contamination with chemical pollutants, entanglement or entrapment in fishing gear, impacts due to persistent debris, and habitat deterioration within coastal waters. The level of impacts acting on these animals is not uniform. Certain species appear to be relatively unaffected and others have experienced events or agents which have measurably affected their populations. Probably the best publicized example has been the documentation of the die-off among bottlenose dolphins inhabiting nearshore waters of the mid- and south Atlantic. Estimates indicate between 25 and 50 percent of the population may have been affected by a still unidentified agent during the years 1987-90. Whether the cause of these deaths was natural or anthropogenic in origin remains unclear. Another species that appears to be under some stress is the harbor porpoise. However, to what extent, if any, the harbor porpoise population has changed over time is not known because census data for this species are either inadequate or unavailable for such analyses.

For information of the cumulative scenario, see the discussion of endangered and threatened cetaceans in this section.

The potential impact-producing factors associated with routine operations which could affect nonendangered and nonthreatened whales are similar to those discussed under the high case scenario for the proposal. They include underwater noise, vessel and helicopter traffic, the discharge of drill muds and cuttings, and pipeline construction.

Special protections will provide safeguards for nonendangered and nonthreatened cetaceans. Should conditions be noted where specific concerns involving nonendangered and nonthreatened cetacean populations are raised, the lessee may be required by the RD to undertake appropriate actions to determine the extent to which nonendangered and nonthreatened cetaceans, their habitat, and its resources may be affected. These actions may result in the modification of proposed operations.

Accidents which have the potential to affect nonendangered and nonthreatened cetacean populations are identified under the discussion of "Endangered Cetaceans" in this section.

Geophysical surveys will likely be conducted, but as mentioned in Sections IV.D.1.a(3) and IV.D.1.b(3)), the extent of this activity cannot be estimated at this time. Startle reactions and avoidance behavior in response to helicopter overflights will also occur at irregular intervals (see Sections IV.A and IV.D.1.a(3)). Notice to Lessee guidelines will reduce the potential for impacts from aircraft flights to levels which would not be expected to measurably affect the distribution, population size, or behavior of nonendangered and nonthreatened cetaceans on the Atlantic OCS. As discussed in Sections IV.A, IV.D.1.a(3), and IV.D.1.b(3), noises from platform activities are the most persistent acoustic source. The noises emitted by platform activities, including the arrival and departure of support traffic is site-specific. At times, noise levels may result in limited avoidance behavior among those species of nonendangered and nonthreatened cetaceans which are intolerant of human activities. Since the scope of the area likely to be affected by platform noise is expected to be small (1 to 5 km radius), no measurable impacts on nonendangered and nonthreatened cetaceans due to noise from fixed-site sources are expected.

As discussed in Sections IV.D.1.a(3) and IV.D.1.b(3), the risk of collisions between nonendangered and nonthreatened whales and support vessels is considered negligible due to the agility of these smaller whales. Were a very few minke or Brydes' whales to be struck by OCS gas and oil vessel traffic, it is not expected that this would result in measurable impacts on the populations of these species.

Muds and cuttings discharges under the cumulative scenario are expected to be equal to those of the high-case scenario (Section IV.D.1.b). Therefore, the expectation of no measurable impacts also applies to the cumulative scenario. These discharges are not expected to measurably affect nonendangered and nonthreatened cetaceans.

The construction of a total of 1130 km (700 mi) of pipeline under this scenario is also equivalent to the requirements of the high-case scenario (see Sections IV.D.1.b and IV.D.1.b(3)). The most likely impact-producing factors associated with this activity will be noise. Because the construction effort will be transient and occur only once, impacts from pipeline construction are not expected to measurably affect the distribution, behavior, or population size of nonendangered and nonthreatened cetacean populations.

In addition to the expected impacts associated with routine activities, nonendangered and nonthreatened cetaceans would continue to be subject to non-OCS sources of impacts which could foreseeably continue over the 40-year cumulative scenario. For the most part, these non-OCS gas and oil impacts are sublethal, although some, such as the bioaccumulation of industrial chemicals or their byproducts and metabolites, are chronic and may be producing unknown or as yet undiagnosed impacts on affected populations. Although the majority of the cetaceans occurring on the Atlantic OCS are pelagic, coastal species such as the bottlenose dolphin appear already to be under some type of biological stress, perhaps due to deteriorating habitat quality or some other factor(s). Other non-OCS impacts which could foreseeably continue over the 30-year duration of the cumulative scenario include direct and indirect impacts due to fisheries activities. Non-gas and oil activities which produce impacts similar or identical to those expected from routine oil and gas operations include military and civil aircraft and vessel traffic, dredging and other marine industrial activities as well as those military actions which cause the generation of noise or discharges.

Details of the assumptions for accidental spills are given in the discussion of endangered cetaceans. Twenty-three chronic operational discharges are assumed for this scenario. The Section IV.D.1.a(3) assumption for similar spills was 20 accidental discharges. Because the numbers of assumed spills are quite similar, it is appropriate to apply the expected impact level for Section IV.D.1.a(3) to this cumulative scenario. Were nonendangered and nonthreatened whales to contact spilled oil or refined hydrocarbon products such as diesel fuel, the affected animals could experience short-term and reversible skin and soft tissue irritation. Among several of the smaller whales, in particular the dolphins, avoidance behavior may be expected (Geraci and St. Aubin, 1982; Geraci et al., 1983; Geraci and St. Aubin, 1987). Because of the generally small quantities of hydrocarbons discharged, and because the spilled materials both evaporate and are rapidly dispersed by wind and wave action, it is not expected that these accidental spills of 1 to 50 bbl will measurably affect populations of nonendangered and nonthreatened Atlantic OCS cetaceans.

Over the 30-year duration of the proposal, 9 foreign import crude oil spills of 1,000 bbl or greater are expected to occur in offshore waters of the mid- and south Atlantic. Such spills are likely to contact pelagic species of nonendangered and nonthreatened cetaceans. As with chronic operational spills and those descriptions of impacts associated with a spill 1,000 bbl or greater as described in Sections IV.D.1.a(3) and IV.D.1.b, the anticipated impacts are sublethal in character. No measurable impact on pelagic populations of nonendangered and nonthreatened cetaceans is expected.

Under this scenario, 4 spills greater than or equal to 1,000 bbl attributable to importing foreign crude oil are assumed to occur in port areas. The bottlenose dolphin would be the cetacean species most likely to be contacted by spills in port locations such as Delaware and Chesapeake bays. It is expected that at least one of these spills will contaminate inshore waters at a time when this species is present.

Dolphins are able to detect surface oil both visually and, using their ability to echolocate, acoustically to a thickness of 1 mm (0.04 in) and 12 mm (0.5 in), respectively. In experiments under controlled conditions, it was observed that following initial exposure to oil, this species consistently avoided further contact. These observations strongly suggest that under natural conditions a similar response would occur and that other potential impacts such as inhalation, ingestion, or measurable bioaccumulation of oil are not expected.

Although the Atlantic population of this species is identified as one considered to be under biological stress it is not expected that the impacts of at least 4 oil spills 1,000 bbl or greater spaced over a 30-year period in coastal or port waters are a source of measurable impacts on the bottlenose dolphin population. However, if the recent events generally described as a "die-off" were the result of some man-made contaminant, either directly or in synergy with other factors, it is conceivable and perhaps probable that animals already in a stressed condition could suffer impacts of a greater severity and duration than those in healthier condition.

It is not expected that measurable effects on nonendangered and nonthreatened cetaceans will result from the actions identified in the cumulative scenario. No unusual, rare, or uncommon ecosystems on which nonendangered or nonthreatened cetaceans are dependent occur at or closely adjacent to areas proposed for leasing.

Potential impact-producing factors associated with the cumulative-case scenario closely parallel those of the high case in many respects. It is not expected that routine gas and oil operations will measurably affect nonendangered and nonthreatened cetacean populations. In the event of accidental oil spills 1,000 bbl or greater discussed here and in Section IV.D.1.a(3), similar expectations of negligible impacts at the population level may be drawn.

CONCLUSION: The cumulative scenario is not expected to result in more than localized and short-term impacts on nonendangered and nonthreatened cetaceans. No measurable changes in the distribution, behavior, or size of nonendangered and nonthreatened cetacean populations on the Atlantic OCS are expected.

(4) Impacts on Terrestrial Mammals

(a) Gulf of Mexico Region

ALABAMA, CHOCTAWHATCHEE, AND PERDIDO KEY BEACH MICE: This cumulative analysis considers the effects of impact-producing factors related to alteration and destruction of habitat; meteorological conditions; predation; competition on the Alabama, Choctawhatchee, and Perdido Key beach mouse; State oil and gas activities; crude oil imports by tankers; and the proposed action, prior, and future OCS sales. These impact-producing factors and their effects are discussed in detail in Section IV.A.

An unknown but substantial amount of coastal construction is possible due to further urbanization, especially in the northeastern Gulf. Coastal development falls under the jurisdiction of individual states and critical habitats for endangered species are protected under the Federal Endangered Species Act. However, it is expected that coastal urbanization will cause endangered mice on the periphery of their habitats to relocate to other habitats less suitable in terms of feeding and nesting. It is expected that this displacement will result in a decline in populations or species resulting in a change in distribution and/or abundance of Alabama, Choctawhatchee, and Perdido Key beach mice in localized areas of the Gulf of Mexico, specifically on barrier islands of Alabama and northwestern Florida. Should coastal urbanization cease, the affected populations or species would stabilize (not increase) within two generations.

Meteorological conditions of natural catastrophes including storms, floods, droughts, and hurricanes can result in substantial damage to Alabama, Choctawhatchee, and Perdido Key beach mice habitats. It is expected that meteorological factors will cause a decline in populations or species resulting in a change in distribution and/or abundance of endangered mice in localized areas of the Gulf of Mexico, specifically on barrier islands of Alabama and northwestern Florida. Should these factors cease adversely affecting endangered mice the populations or species will return to their former level within one to two generations.

Dredge and fill activities occur throughout the nearshore areas of the United States. They range in scope from propeller dredging by recreational boats to large-scale navigation dredging and fill for land reclamation. It is expected that dredge and fill activities will cause a decline in populations or species resulting in a change in distribution and/or abundance of endangered mice in localized areas of the Gulf of Mexico, specifically on barrier islands of Alabama and northwestern Florida. Should dredge and fill activities cease adversely affecting endangered mice the populations or species will return to their former level within one to two generations.

Predation by dogs and cats and competition by house mice have a substantial effect on these beach mice. The number of deaths is unknown and the nature of the activities causes unreliable estimates. However, these activities are considered the most damaging to Alabama, Choctawhatchee, and Perdido Key beach mice populations in the Gulf of Mexico (USDOI, FWS, 1987a). Both mortalities and sublethal effects are expected from these activities. It is expected that predation and competition will cause a decline in populations or species resulting in a change in distribution and/or abundance of endangered mice in localized areas of the Gulf of Mexico, specifically on barrier islands of Alabama and northwestern Florida. Should predation and competition be brought under control and cease adversely affecting endangered mice the populations or species will return to their former level within two to three generations.

A number of activities associated with State oil and gas operations could impact the Alabama, Choctawhatchee, and Perdido Key beach mouse. These would include routine operational discharges and accidental spills associated with coastal refining and processing activities, and pipeline activities (construction through barrier islands). The effects on the Alabama, Choctawhatchee, and Perdido Key beach mouse would be similar to those discussed in the base case.

The Alabama, Choctawhatchee, and Perdido Key beach mice occupy habitats restricted to barrier islands in the mature coastal dune of Florida and Alabama. The preferred habitat of Alabama, Choctawhatchee, and Perdido Key beach mice is not on the beach, but behind the barrier dunes. An oil spill would have to breach the dunes to reach either the mice or their preferred habitat (USDOI, FWS, 1987a). This could occur only if an oil spill coincided with a storm surge. The home range of the beach mice is within areas which receive particular consideration during oil spill cleanup. Because of the critical designation and general status of those areas, oil spill contingency plans include special notice to minimize adverse effects from vehicular traffic during cleanup activities and to maximize the protection efforts to prevent contact of these areas with spilled oil (Appendix D).

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)). That description includes assumptions of oil spill occurrences, spill sizes, and likely contacts with shoreline and wetland areas.

Petroleum product spills that occur offshore Alabama and the Florida Panhandle are not expected to contact areas beyond the beach unless coincident with a storm surge. Farther to the south, a petroleum product spill could contact mangrove swamp habitat. For example, a diesel oil spill in the Tampa Bay area would contact mainly mangrove swamp. Assuming that two product spills occur in the Tampa area, and that one contacts the coast, up to 25 ha of mangrove habitat will be affected.

It is assumed that there will be contact between endangered mice and spilled oil as a result of factors related to the proposed action plus those related to prior and future OCS sales, and crude oil imports by tanker. It is expected that the extent and severity of effects from oil spills of any size will be lessened by improved coastal oil spill contingency planning and response, deterrence of endangered mice away from the immediate area of an oil spill, and increased percentage of survival from rehabilitation efforts (Appendix D). In the event that oiling of the Alabama, Choctawhatchee and Perdido Key mice by large oil spills should occur, it is expected that the effects would primarily be sublethal with fewer than five deaths. The effects of small oil spills on these mice are expected to be solely sublethal due to the inconsiderable area affected. In the event that oil spills of any size should reach critical habitats for feeding or nesting areas of endangered mice behind barrier dunes, sublethal effects are expected because oil spill contingency plans include special notice to minimize adverse effects from vehicular traffic during cleanup activities. The effect on Alabama, Choctawhatchee, and Perdido Key beach mice from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All deaths of endangered mice affected by spilled oil will be replaced through natural recruitment within two to three generations.

In summary, a number of activities such as oil spills and oil spill response activities, alteration and destruction of habitat, meteorological conditions, predation and competition may adversely affect Alabama, Choctawhatchee, and Perdido Key beach mice. It is expected that habitat loss from natural catastrophes, coastal urbanization, and dredge and fill activities will cause a decline in Alabama, Choctawhatchee, and Perdido Key beach mice populations or species resulting in a change in distribution and/or abundance of endangered mice in the Gulf of Mexico, specifically on barrier island of Alabama and northwestern Florida. Predation by dogs and cats and competition by house mice are considered the most damaging to Alabama, Choctawhatchee, and Perdido Key beach mice populations and both deaths and sublethal effects are expected. Accidental discharges of oil and produced products are expected to affect several thousand hectares of wetlands and hundreds of kilometers of coastline. The effect on Alabama, Choctawhatchee, and Perdido Key beach mice from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. In the event that oil spills of any size should reach critical habitats for feeding or nesting areas of endangered mice behind barrier dunes, sublethal effects lasting less than one generation are expected because oil spill contingency plans include special notice to minimize adverse effects from vehicular traffic during cleanup activities.

CONCLUSION: Under the cumulative scenario, there will be a decline in Alabama, Choctawhatchee, and Perdido beach mice populations or species, resulting in a change in distribution and/or abundance in the Gulf of Mexico Region, specifically on barrier islands of Alabama and northwestern Florida. All endangered mice affected by spilled oil will be replaced through natural recruitment within two to three generations. Predation by dogs and cats and competition by house mice are considered the most damaging to endangered beach mice populations. There is no contribution of the proposed action (as analyzed in Section IV.D.1.a(4)) to the cumulative impact because it is expected that from the proposed action there would be no adverse effects to endangered beach mice.

(b) Alaska Region

CARIBOU: Activities that could produce adverse impacts in the arctic caribou population include routine and accidental activities associated with offshore and onshore oil and gas development on current and future State of Alaska Beaufort Sea leases, oil and gas development on the ANWR and NPR-A, Canadian Beaufort oil and gas development, the Red Dog Mine, and the subsistence and sport harvests.

Routine noise and activity (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Beaufort and Chukchi Seas, including aircraft and vehicle traffic and construction/operation/maintenance of industrial facilities could adversely impact the population. While foraging, caribou may contact or ingest oil or inhale vapors of oil stranded on beaches or released from onshore pipelines. Spill-cleanup operations are expected to cause caribou to temporarily abandon the affected areas.

Onshore activity associated with non-OCS oil and gas development on State leases, oil development in ANWR and NPR-A, and Canadian Beaufort development, is expected to disturb and displace some proportion of caribou occupying the coastal plain. The extent of disturbance would depend on the timing, extent, and specific location of oil development and the duration (a few hours to several years) and intensity (few vehicles and aircraft/day to several hundred/day) of the disturbance. Disturbance of caribou by helicopter traffic associated with oil development is expected to briefly displace some caribou (particularly cow/calf groups) from feeding and resting areas and require less than a generation for recovery. Of greatest concern is disturbance of caribou by vehicles using roads adjacent to pipelines. Caribou are hesitant to cross under an elevated pipeline adjacent to a road, especially when vehicle traffic is present. However, caribou do successfully cross pipeline-road complexes and numerous highways in Alaska and Canada with no apparent effect on herd distribution, abundance, or integrity, especially when they are highly motivated to seek relief from insect harassment.

The present level of oil development in the Prudhoe Bay/Kuparuk area (1,797 km of pipelines, 553 km of roads, 2,847 ha of habitat covered by facilities encompassing 800 km^2) apparently has caused only minor displacement of Central Arctic herd caribou from a small portion (5%) of the calving range, with no demonstrated effect on herd abundance or overall distribution. The displacement of cow/calf groups from additional parts of the calving range (estimated 14-37% of the calving area occupied by various herds) associated with future oil development for the life of the projects is expected to further restrict their use of the available arctic slope calving habitat and cause a reduction in distribution or abundance, and require the equivalent of one or two generations for recovery; but long-term (e.g., three generations or more) reduction in herd productivity resulting in a population decline are not expected.

Onshore facilities associated with oil development (shore bases, pump stations, gravel quarries, roads and pipelines, and drill pads) alone are expected to have minimal disturbance and habitat-removal effects on caribou, requiring less than the equivalent of a generation for recovery or compensation, because they generally would not affect caribou over a large geographic area (perhaps 1-3% of the available range). Reduction in local habitat use within about four km of facilities under construction, gravel pits, and operational drill sites, and the avoidance by cows with calves of habitat areas with high levels of road traffic, although representing less than one percent of available caribou habitat, are expected to have a more substantial effect on the distribution of caribou, and require more than the equivalent of one generation for recovery. Roads and gravel pads provide caribou with additional insect-relief habitat.

Oil spills from offshore and onshore activities associated with oil and gas development are expected to have little impact on caribou distribution, abundance, or reproduction, because few are likely to be contaminated by oil or ingest contaminated vegetation.

Loss of Western Arctic herd grazing range as a result of Red Dog Mine development on the Lisburne Peninsula represents a small percentage of that available and thus is expected to have a minimal impact on the herd. Mortality from subsistence and sport harvests of arctic caribou probably is less than 17,000 animals, perhaps 2 to 3 percent of the population; because the herds are increasing in size, it is expected that such losses are recovered in less than a generation.

Impacts of routine and accidental activities associated with OCS oil and gas development are expected to be no greater than those discussed above for non-OCS development. Impacts of spill-cleanup operations, either on beaches or along pipelines, are expected to be minimal.

Routine and accidental impacts of non-OCS oil and gas development on arctic caribou are expected to result in losses requiring one to two generations for recovery to the original status. Losses from subsistence and sport harvests apparently are recovered within less than a generation. Routine and accidental impacts of OCS oil and gas development are expected to be similar to those described for non-OCS development.

CONCLUSIONS: Overall cumulative impact on the arctic caribou population is expected to require two generations or more for recovery during the 24 to 32-year life of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development. For the proposal, the impacts are expected to require up to one generation for recovery.

(5) Impacts on Marine and Coastal Birds

(a) Gulf of Mexico Region

1) Threatened or Endangered Species

This cumulative analysis considers the present status of populations, and migratory habits of threatened and endangered marine and coastal birds, and the effects of impact-producing factors that may occur and adversely affect those populations. These factors include commercial and recreational offshore and coastal activities; geographical and meteorological conditions; State oil and gas activity; crude oil imports by tanker; and the proposed action, prior, and future OCS sales. These impact-producing factors and their effects are discussed in detail in Section IV.A.

The brown pelican and piping plover, because they are the species most closely associated with near-shore waters, can become entangled in monofilament fishing line, netting, six-pack yokes, etc., which may result in injury or mortality. Ingestion of plastic and styrofoam materials may cause internal blockage, resulting in injury or mortality (Centaur Associates, Inc. and Center for Environmental Education, 1986). Ingested plastic may impair feeding activity where plastic reduces the food storage volume of the stomach and limits the accumulation of fat reserves essential for reproduction and migration (Ryan, 1988). However, the MMS prohibits the disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR 250.40). In addition, MARPOL, Annex V, Public Law 100-220 (101 Statute 1458), which prohibits the disposal of any plastics at sea or in coastal waters, went into effect January 1, 1989. It is assumed that the combination of lessees obeying special MMS prohibitions and enactment of MARPOL, Annex 5, greatly reduces if not eliminates future OCS-related loss of trash and debris. The effect on the brown pelican and piping plover from

OCS oil/gas-related trash and debris from the proposed action plus those related to prior and future OCS sales, State oil and gas activity is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 100 birds.

Meteorological conditions of coastal storms and hurricanes cause flooding and destruction of nesting, resting, and feeding areas, resulting in losses of threatened and endangered birds and their critical habitats. High levels of oil and organic chemical contamination in the river runoff into the northern Gulf of Mexico cause direct mortality of endangered avian species and indirect food loss. Collision with power lines and supporting towers causes additional losses of endangered raptors such as the Arctic peregrine falcon and bald eagle (Avery et al., 1980). It is expected that coastal storms and hurricanes, contamination by Mississippi River runoff, and, in the case of endangered raptors, collision with power lines and supporting towers will cause a decline in populations or species of threatened and endangered birds resulting in a change in distribution and/or abundance of threatened and endangered marine and coastal birds in localized areas of the Gulf of Mexico. Should these factors cease adversely affecting threatened and endangered marine and coastal birds the populations or species will return to their former level within one to two generations.

Comprehensive information on oil and gas activities in State waters in the Gulf of Mexico region has not been compiled. Many oil and gas activities carried out in State waters prior to the 1950's were neither documented nor permitted in the way they are now, and information is scarce or lacking. According to the Baker-Hughes November 1991 rig count, of the nearly 400 rigs operating in the five Gulf coastal States, approximately 30 drilling rigs and 29 drilling barges were operating in State waters (Texas-15 rigs, Louisiana-13 rigs and 29 inland drilling barges, and Alabama-3). A number of activities associated with State oil and gas operations could impact marine and coastal birds. These would include routine operational discharges and accidental spills; refining and processing activities; support vessel traffic; pipeline activities; coastal geophysical and platform removal activities using explosives; and transport, storage, and disposal of oilfield wastes. The effects on marine and coastal birds would be similar to those discussed in some detail in the base case and below.

The storage of oily industrial waste in open pits, within five southern states, may seriously deplete populations of birds migrating to the Gulf of Mexico. Migrating threatened and endangered birds, especially bald eagles and Arctic peregrine falcons, are especially susceptible because they apparently will feed on dead migrating waterfowl and ingest oiled carrion. It is assumed storage of oily waste in pits accessible to migrating waterfowl and endangered raptors will continue. Sublethal effects on threatened and endangered birds are expected to occur through ingestion of oiled carrion and ingestion of oil during preening. It is expected that the storage of oily waste in pits will cause a decline in endangered raptor populations or species resulting in a change in distribution and/or abundance of threatened and endangered birds in the Gulf of Mexico. Should storage of oily waste in accessible pits cease, the affected populations or species would stabilize (not increase) within two generations.

Approximately 200,000 helicopter trips in support of the proposed action, prior and future OCS sales will be flown per year. The FAA Advisory Circular 91-36c, prohibits the use of fixed-wing aircraft lower than an elevation of about 150 m and helicopters lower than about 300 m during the period of time (October 15 - April 15) that migratory endangered birds are in the vicinity of numerous National Wildlife Refuges in the Gulf of Mexico (Biological Opinion - Section 7 Consultation Proposed Exploration Plans for OCS in the Gulf of Mexico; FWS/OES 375.0; USDOI, MMS, 1990b). These wildlife refuges provide important feeding, resting, and nesting areas for all threatened and endangered birds, but especially for the whooping crane in coastal Texas. Although an incident between OCS-related traffic and endangered birds may occur and be disruptive, the effect is at worst of a sublethal, temporary nature lasting less than a few hours. It is assumed that helicopter traffic near critical feeding, resting or nesting areas will not disturb the brown pelican, arctic peregrine falcon, bald eagle, piping plover, or whooping crane because of special prohibitions and adherence to the general FAA recommended minimum ceiling of 300 m. It is expected that OCS-related offshore flights will not affect threatened and endangered birds.

Service vessels comprise the greatest amount of marine traffic associated OCS activities. It is estimate that approximately 12,000 service vessel trips in support of the proposed action, prior and future OCS sales will be completed per year. This represents less than 5 percent of the total annual vessel traffic in the Gulf of Mexico. It is assumed that greater than 95 percent of the OCS-related oil/gas traffic will occur in/out of existing port areas that are well away from critical habitats for feeding, resting, or nesting areas of the arctic peregrine falcon, bald eagle, piping plover, or whooping crane and will not disturb these birds.

OCS-related service vessel traffic occurs in the vicinity of Cameron, Intercoastal City, Morgan City, and Venice, Louisiana, and in the vicinity of Port O'Connor, Freeport, Galveston, and Sabine Pass, Texas, within 2-3 miles of critical habitats for feeding, resting or nesting areas of the brown pelican. Although brown pelicans can be startled by service vessel traffic, traffic must be closer than one-half mile and the effect is at worst of a sublethal, temporary nature lasting less than a few hours. It is assumed that service-vessel traffic will not disturb the brown pelican because of the distance between them. It is expected that OCS-related service-vessel traffic will not affect threatened and endangered birds.

Disturbance of brown pelican, arctic peregrine falcon, piping plover, and whooping crane from critical habitats for feeding, resting, or nesting due to pipeline landfalls and onshore construction could result in a reduction or desertion of birds that use the habitats. It is estimated that eight new OCS oil/gas-related pipeline landfalls will be constructed in support of the proposed action, prior, and future OCS sales. Likely locations for these landfalls are the Mobile, Alabama and Pascagoula, Mississippi areas, the mouth of the Mississippi River, and the south Texas coast. No pipeline landfalls are projected for the northeastern Gulf. The eight landfalls and piping through coastal areas are estimated to affect 54 ha of marine and coastal bird habitat. It is assumed that pipeline landfalls will not affect any threatened and endangered birds or their habitat due to the recognition and prohibition of alteration within critical habitats. It is expected that construction of pipeline landfalls will not disturb and/or displace threatened and endangered birds within and from, respectively, 54 ha of coastal habitat.

It is estimated that one pipeyard and six terminals will be constructed in support of the proposed action, prior, and future OCS sales. These facilities are assumed for the Mobile, Alabama area and south Texas where an adequate supply of upland is located near waterways. There are regulatory difficulties in permitting new construction projects in wetlands and higher costs when compared to construction in upland areas. It is assumed that construction of these facilities will be done on uplands and will not disturb wetland areas of the brown pelican, arctic peregrine falcon, piping plover, and whooping crane. However, since there are prohibitions against construction in upland considered critical for bald eagles, it is assumed that construction of pipeyards and terminals will not disturb bald eagles. It is expected that construction of pipeyards and terminals will not affect threatened and endangered birds.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)).

It is assumed that there will be contact between threatened and endangered birds and spilled oil as a result of the proposed action. The brown pelican, piping plover, and bald eagle in the northeastern Gulf because they are the species most closely associated with nearshore waters, are the species most likely to be contacted by the assumed 1,000 bbl or greater oil spill. The bald eagle, which is restricted to upland and wetland areas 30-50 miles from the Gulf's northcentral and northeastern coastline, is most unlikely to be contacted by any assumed oil spills. It is assumed that the extent and severity of effects from oil spills of any size will be lessened by improved coastal oil spill contingency planning and response, deterrence/scaring of birds away from the immediate area of an oil spill, and increased percentage of survival from rehabilitation efforts (Appendix D). In the event that oiling of the brown pelican, piping plover, and bald eagle by oil spills (1,000 bbl or greater) should occur, it is expected that the effects would primarily be sublethal with fewer than 10 deaths. The effects of small oil spills on the brown pelican, arctic peregrine falcon, piping plover, and whooping crane are expected to be solely sublethal due to the inconsiderable area affected. In the event that oil spills of any size should occur in critical habitats for feeding, resting, or nesting, such as inshore, intertidal, and nearshore areas, sublethal effects are expected. The effect on threatened and endangered birds from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths of the brown pelican and piping plover. All deaths of the brown pelican, piping plover, bald eagle affected by spilled oil will be replaced through natural recruitment within two to three generations.

In summary, a number of activities such as habitat loss, State oil and gas activities, OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities, coastal urbanization, commercial and recreational offshore activities and meteorological conditions may adversely affect threatened and endangered marine and coastal birds. It is expected that habitat loss and reproductive failure will cause a decline in threatened and endangered bird populations or species resulting in a change in distribution and/or abundance of threatened and endangered marine and coastal birds in the Gulf of Mexico. It is expected that meteorological conditions of coastal storms and hurricanes, contamination by Mississippi River runoff, and, in the case of endangered raptors, collision with power lines and supporting towers will cause a decline in threatened and endangered populations or species and their habitat resulting in a change in distribution and/or abundance of threatened and endangered marine and coastal birds in localized areas of the Gulf of Mexico. It is expected that the storage of oily waste in open pits by five southern states will cause a decline in bald eagle and Arctic peregrine falcon populations or species resulting in a change in distribution and/or abundance of these endangered raptors in the Gulf of Mexico. It is expected that OCS offshore flights will not disturb threatened and endangered marine and coastal birds because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. It is expected that vessel traffic will not disturb marine and coastal birds because it occurs in/out of existing port areas greater than one-half mile from critical habitats. It is expected that construction of pipeline landfalls, pipeyards, and terminals will not disturb or displace threatened and endangered marine and coastal birds because they will not be constructed in critical habitat within upland or wetland areas. Accidental discharges of oil and produced products are expected to affect several thousand hectares of wetlands and hundreds of kilometers of coastline. The effect on threatened and endangered birds from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths of the brown pelican and piping plover. All mortalities of the brown pelican and piping plover affected by spilled oil will be replaced through natural recruitment within two to three generations.

CONCLUSION: Under the cumulative scenario there will be a decline in an threatened and endangered marine or coastal bird population(s) or species, resulting in a change in distribution and/or abundance in the Gulf of Mexico Region. All threatened and endangered marine and coastal birds affected by spilled oil will be replaced through natural recruitment within two to three generations. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a) to the cumulative impact is negligible because it is expected that from the proposed action there would be no discernible decline in an endangered or threatened bird population or species, and no change in distribution or abundance.

2) Nonendangered Species

This cumulative analysis considers the present status of populations, and migratory habits of marine and coastal birds, and the effects of impact-producing factors related to the proposed action plus those related to commercial and recreational offshore and coastal activities; geographical and meteorological conditions; State oil and gas activity; crude oil imports by tanker; the proposed action, prior and future OCS sales that may occur, and adversely affect those populations. These impact-producing factors and their effects are discussed in detail in Section IV.A.

An unknown but substantial amount of coastal construction is possible due to further urbanization, especially in the northeastern Gulf. Coastal development falls under the jurisdiction of individual states. However, it is expected that coastal urbanization, wherever it occurs in the Gulf of Mexico, will cause marine and coastal birds to relocate to other, possibly less suitable habitats. It is expected that this displacement will result in a decline in populations or species resulting in a change in distribution and/or abundance of marine and coastal birds in localized areas of the Gulf of Mexico. Should coastal urbanization cease, the affected populations or species would stabilize (not increase) within two generations.

Marine and coastal birds can become entangled in monofilament fishing line, netting, six-pack yokes, etc., which may result in injury or death. Ingestion of plastic and styrofoam materials may cause internal blockage, resulting in injury or death (Centaur Associates, Inc. and Center for Environmental Education, 1986). Ingested plastic may impair feeding activity where plastic reduces the food storage volume of the stomach and limits the accumulation of fat reserves essential for reproduction and migration (Ryan, 1988). However, the MMS prohibits the disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR 250.40). In addition, MARPOL, Annex V, Public Law 100-220 (101 Statute 1458), which prohibits the disposal of any plastics at sea or in coastal waters, went into effect January 1, 1989. It is assumed that the combination of lessees obeying special MMS prohibitions and enactment of MARPOL, Annex 5, greatly reduces if not eliminates future OCS-related loss of trash and debris. The effect on marine and coastal birds from OCS oil/gas-related trash and debris is expected to be undetectable and any birds affected will be replaced through natural recruitment from the next generation.

Coastal storms and hurricanes cause flooding and destruction of nesting and feeding areas, resulting in losses of marine and coastal birds. High levels of oil and organic chemical contamination in the river runoff into the northern Gulf of Mexico cause direct mortality of avian species and indirect food loss. Collision with power lines and supporting towers causes additional bird deaths (Avery, et al., 1980). It is expected that coastal storms and hurricanes, contamination by Mississippi River runoff, and collision with power lines and supporting towers will cause a decline in populations or species resulting in a change in distribution and/or abundance of marine and coastal birds in localized areas of the Gulf of Mexico. Should these factors cease adversely affecting marine and coastal birds the populations or species will return to their former level within one to two generations.

A number of activities associated with State oil and gas operations could impact marine and coastal birds. These would include routine operational discharges and accidental spills; refining and processing activities; support vessel traffic; pipeline activities; coastal geophysical and platform removal activities using explosives; and transport, storage, and disposal of oilfield wastes. The effects on marine and coastal birds would be similar to those discussed in some detail in the base case and below.

The storage of oily industrial waste in open pits, within five southern states, may seriously deplete populations of birds migrating to the Gulf of Mexico. Migrating waterfowl are especially susceptible because they apparently mistake the reflection of uncovered oil pits and tanks for freshwater. It is assumed storage of oily waste in pits accessible to migrating waterfowl will continue. Mortalities are expected to occur through direct oiling and sublethal effects through ingestion of oil during preening. It is expected that the storage of oily waste in pits will cause a decline in waterfowl populations or species resulting in a change in distribution and/or abundance of marine and coastal birds in the Gulf of Mexico. Should storage of oily waste in accessible pits cease, the affected populations or species would stabilize (not increase) within two generations.

Approximately 200,000 helicopter trips in support of the proposed action, prior, and future OCS sales will be flown per year. The MMS prohibits the use of fixed-wing aircraft lower than an elevation of about 150 m and helicopters lower than about 300 m during the period of October 15 through April 15 in the vicinity of numerous National Wildlife Refuges in the Gulf of Mexico in order to prevent disturbances to the birds (Biological Opinion - Section 7 Consultation Proposed Exploration Plans for OCS in the Gulf of Mexico; FWS/OES 375.0 USDOI, MMS, 1990b). The majority of these wildlife refuges provide important feeding, resting, and nesting areas for marine and coastal birds. Although an incident may occur and be disruptive, the effect is at worst of a temporary nature lasting less than a few hours. It is assumed that helicopter traffic will obey special prohibitions and adhere to the general FAA recommended minimum ceiling of 300 m and will not disturb Gulf marine and coastal birds. It is expected that OCS-related offshore flights will not affect marine and coastal birds.

Service vessels comprise the greatest amount of marine traffic associated OCS activities. It is estimate that approximately 12,000 service vessel trips in support of the proposed action, prior, and future OCS sales will be completed per year. This represents less than 5 percent of the total annual vessel traffic in the Gulf of Mexico. It is assumed that greater than 95 percent of the OCS-related oil/gas traffic will occur in/out of existing port areas and will not disturb Gulf marine and coastal birds. It is expected that OCS-related service-vessel traffic will not affect marine and coastal birds.

It is estimated that eight new OCS oil/gas-related pipeline landfalls will be constructed in support of the proposed action, prior, and future OCS sales. Likely locations for these landfalls are the Mobile, Alabama and Pascagoula, Mississippi areas, the mouth of the Mississippi River, and the south Texas coast. No pipeline landfalls are projected for the eastern Gulf. The eight landfalls and piping through coastal areas are estimated to affect 54 ha of marine and coastal bird habitat. It is expected that construction of pipeline landfalls will disturb and/or displace marine and coastal birds within and from, respectively, 54 ha of coastal habitat.

It is estimated that one pipeyard and six terminals will be constructed in support of the proposed action, prior, and future OCS sales. These facilities are assumed for the Mobile, Alabama area and south Texas where an adequate supply of upland is located near waterways. There are regulatory difficulties in permitting new construction projects in wetlands and higher costs when compared to construction in upland areas. It is assumed that construction of these facilities will be done on uplands and will not disturb marine and coastal birds. It is expected that construction of pipeyards and terminals will not affect marine and coastal birds.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)).

It is assumed that there will be contact between marine and coastal birds and their habitats and spilled oil as a result of factors related to the proposed action plus those related to prior and future OCS sales, State oil and gas activity, and crude oil imports by tanker. The extent and severity of effects will be lessened by improved coastal oil spill contingency planning and response, deterrence of birds away from the oiled area, and increased percentage of survival from rehabilitation efforts. Lethal effects are expected for no more than 10,000 birds from direct oiling. Sublethal effects are expected for no more than 100,000 birds from contact with oil and contamination of food sources. All marine and coastal birds affected by spilled oil will be replaced through natural recruitment within two to three generations.

In summary, a number of activities such as habitat loss, State oil and gas activities, OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities, coastal urbanization, commercial and recreational offshore activities, and meteorological conditions may adversely affect marine and coastal birds. It is expected that habitat loss will cause a decline in populations or species resulting in a change in distribution and/or abundance of marine and coastal birds in the Gulf of Mexico. It is expected that coastal urbanization, wherever it occurs in the Gulf of Mexico, will cause marine and coastal birds to relocate to other, possibly less suitable habitats. It is expected that this displacement will result in a decline in populations or species resulting in a change in distribution and/or abundance of marine and coastal birds in localized areas of the Gulf of Mexico. It is expected that coastal storms and hurricanes, contamination by Mississippi River runoff, and collision with power lines and supporting towers will cause a decline in populations or species resulting in a change in distribution and/or abundance of marine and coastal birds in localized areas of the Gulf of Mexico. It is expected that the storage of oily waste in open pits by five southern states will cause a decline in waterfowl populations or species resulting in a change in distribution and/or abundance of marine and coastal birds in the Gulf of Mexico. It is expected that OCS offshore flights will not disturb marine and coastal birds because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. It is expected that vessel traffic will not disturb marine and coastal birds because it occurs in/out of existing port areas. It is expected that pipeline landfalls will disturb and/or displace marine and coastal birds within and from, respectively, 54 ha of coastal area. It is expected that construction of pipeyards and terminals will not disturb or displace marine and coastal birds because they will be constructed in upland areas and not in wetlands. Accidental discharges of oil and produced products are expected to affect several thousand hectares of wetlands and hundreds of kilometers of coastline. Lethal effects are expected for no more than 10,000 birds from direct oiling. Sublethal effects are expected for no more than 100,000 birds from contact with oil and contamination of food sources.

CONCLUSION: Under the cumulative scenario there will be a decline in a marine or coastal bird population(s) or species, resulting in a change in distribution and/or abundance in the Gulf of Mexico Region. All marine and coastal birds affected by spilled oil will be replaced through natural recruitment within two to three generations. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a) to the cumulative impact is negligible because it is expected that from the proposed action there would be no discernible decline in a coastal or marine bird population or species, and no change in distribution or abundance.

(b) Alaska Region

1) Threatened or Endangered Species

i. Arctic and American Peregrine Falcons

There are a limited number of the OCS and non-OCS projects or proposals that could affect peregrine falcons. However, any noisy activity or large-scale habitat alteration near nesting sites and locations are the types of actions that would adversely affect peregrine falcons. An existing project that may affect arctic peregrine falcons would be offshore mining in Alaskan waters near Nome. Potential effects as a result of this project would be related to the mining and processing of the ore. As a result of these activities, mercury concentrations in the water column may be increased. Mercury can readily bioaccumulate and biomagnify within the marine food chain and eventually result in reduced reproductive success in birds. Assuming that mining continues, this activity could affect up to 10 percent of the existing population each year.

Several pairs of arctic peregrine falcons nest on coastline cliffs in the area and feed on resident seabirds. Consequently, mercury may affect seabird reproduction and eventually result in the reduction of prey availability for the falcons. It also may accumulate at high levels in the peregrine falcons and cause direct mortality or accompanying reduced reproductive success. Assuming this occurs, the effect of mercury on peregrine falcons may result in the loss of some of the six nesting pairs near the Norton Sound sale area and would be expected to result in the loss of 20 to 30 pairs of the northwest Alaska coastal arctic peregrine falcon population (USDOI, MMS, 1990a).

Previous Federal and State oil and gas lease sales have the potential to affect arctic peregrine falcons. Nesting peregrine falcons could be disturbed by the noise of helicopters passing low overhead between support bases and exploration units or production platforms. This disturbance could result in abandonment of nest sites, nestling mortality, and reduced reproductive rates.

However, few such encounters are expected. Such disturbances could affect up to 10 percent of the peregrine falcon population each year.

The use of persistent pesticides even in reduced quantities has resulted in continued contamination in the peregrine falcon. The ban of DDT and related pesticides in the U.S. has greatly reduced the bioaccumulation of these chemicals in peregrine falcons; thereby, it has reduced reproductive failures. However, the continued use of persistent pesticides (including DDT) in the Third World countries of Central and South America where peregrines winter and migrate, may have resulted in a persistence of contamination in peregrine falcons. Habitat destruction also can adversely affect peregrine falcons. Large-scale habitat destruction in Central and South America (e.g., clearing of forests for agriculture). Commercial and residential construction in coastal areas could result in less suitable habitat and prey for peregrine falcons, which could result in a lower reproductive rate.

Destruction of wetlands along migration routes and within feeding territories also could reduce the prey base and slow the recovery of the falcon species. Assuming that these agents persist, it is estimated that they would affect 5 to 25 percent of the peregrine falcon population each year.

The effect on peregrine falcons as a result of the activities associated with the OCS cumulative case would be similar in nature to those previously described. Higher effects levels may be estimated from increased levels of noise and disturbance from helicopter operations associated with the increased levels of exploration and production anticipated. The development and production scenario for the Chukchi Sea area (USDOI, MMS, 1991a) anticipates construction of an onshore pipeline from Point Belcher to the TAP The pipeline has the potential to pass in close proximity to a number of peregrine falcon-nesting sites. Assuming that these activities occur in areas where peregrines are feeding and nesting, they would probably disturb a number of nesting pairs and may lead to abandonment of up to 50 percent of the nest sites, up to 100 percent nestling mortality at these sites, and cause a reduced rate (up to 50 percent) of reproduction.

Oil spills have the potential to affect peregrine falcons. Peregrine falcons feed principally on birds, preferring to take their prey in flight. Consequently, it is improbable that spilled oil would contact the falcons directly. However, it is possible that peregrines could be oiled while feeding on partially oiled seabirds, waterfowl, or shorebirds. Also, peregrines could be affected by a reduction in prey availability, if a large number of birds in the area are contacted by spilled oil and die. The cumulative-case estimates that four platform, six pipeline, and seven tanker spills would occur over the life of the proposal. Assuming that these oil spills contact feeding areas for peregrine falcons, it is estimated that they would indirectly affect from up to 25 percent of the peregrine falcon population in Alaska, and would result in from up to 50 percent mortality to same. Assuming that these oil spills do not occur in feeding areas, they would not affect the peregrine falcon population in Alaska.

CONCLUSION: Under the cumulative scenario, noise is estimated to lead to abandonment of about up to 50 percent of the local peregrine falcon nest sites, resulting in nestling mortality at those sites, and cause a reduced rate (up to 50 percent) of reproduction. Up to 50 percent of this is estimated to be due to the proposed program. Assuming that the projected number of oil spills for the cumulative case contacts feeding areas for peregrine falcons, these spills would indirectly affect from up to 25 percent of the peregrine falcon population in Alaska and would result in from up to 50 percent mortality to same. An estimated 60 percent of this is due to the proposal. This decline in species numbers would last longer than 5 years. Assuming that these oil spills do not occur in feeding areas, then they would not affect the peregrine falcon population in Alaska.

b) Short-Tailed Albatross

Effects on the short-tailed albatross associated with the cumulative case could result from activities associated with prior OCS lease sales and commercial fishing. Prior lease sales would result in activities such as vessel movements (including icebreakers), seismic surveys, dredging, drilling, drillships, pipeline construction, and production operations. The cumulative-case estimates about three times the level of exploration/production activity projected for the base case. If there were short-tailed albatrosses in the vicinity, these activities could result in disturbance if albatrosses were feeding in the area, or could cause injury or mortality due to ingestion or entanglement in discarded plastics or other debris. Albatrosses have been observed to ingest plastics (Day et al., 1985), and it appears that plastic pollution is a growing threat to the species (Hasegawa, 1988, pers. comm.). However, due to the low number of short-tailed albatrosses in Alaska and their widespread distribution, they are not likely to be in the area where OCS activities are occurring. Also, Offshore Operating Regulations (30 CFR 250), which govern oil and gas activities on the Federal OCS, prohibit the disposal of solid wastes and other materials at sea. If disturbance, entanglement in debris, or consumption of plastics occurs they are not expected to affect more than about 6 percent of the albatross population each year. The majority of these effects would be sublethal.

Effects associated with the cumulative case also could result from activities associated with commercial fishing. Short-tailed albatrosses feed on the surface and will sometimes follow vessels to feed on discarded materials. This behavior could result in feeding birds becoming entangled in fishing nets or other related gear, including that which may have been discarded. The commercial fishing industry also may compete with the albatross for food-fish resources such as walleye pollock and sablefish, if large numbers of juveniles are incidentally caught in nets. Albatrosses also could be harmed or die from petroleum-based products that leak or are spilled by vessels in the commercial-fishing fleet. While short-tailed albatrosses are not likely to frequent commercial-fishing areas due to their low numbers, they are more likely to be attracted to such activities (rather than oil and gas activities) if any were in the area. Nevertheless, commercial fishing is not expected to affect more than 10 percent of the short-tailed albatross population. About half of these effects could be lethal.

Other effects associated with the cumulative case of the proposal are those associated with an oil spill (1000 barrels or greater). If short-tailed albatrosses were feeding in the vicinity of an OCS activity during an oil spill, it is probable that they would be coated with oil and would die. However, the short-tailed albatross is an infrequent to rare visitor to the Alaskan OCS, and the estimated 400 individuals in the population are scattered over much of the North Pacific and the Bering Sea from May to November. About 10 oil spills are estimated to occur associated with the cumulative case within the range of the short-tailed albatross. If these occurred during the period when albatrosses were feeding in the area, it is estimated that they would lethally affect up to 50 percent of population, depending on the number of birds in the area.

CONCLUSION: Based on the assumptions in the text, routine activities associated with the prior OCS lease sales, commercial fishing and the proposed program are not expected to affect more than about 5 percent of the short-tailed albatross population. Less than 2 percent of this is estimated to be due to the proposed program. The majority of these effects would be sublethal. Commercial fishing is not expected to affect more than 10 percent of the short-tailed albatross population. About half of these effects could be lethal. Oil spills from all sources are expected to lethally affect about up to 50 percent of the population, depending on the number of birds feeding in the area.

2) Nonendangered Species

a) Bald Eagle (Alaska Population)

Activities that could produce adverse impacts on the bald eagle population in Alaska include routine and accidental activities associated with oil and gas development on current and future State of Alaska leases in Cook Inlet; transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP; transport of oil from the TAP by tanker to Cook Inlet refineries; transport of Cook Inlet production to Far East markets; oil-spill-cleanup operations; nesting-habitat degradation from timber harvest, land development, fires and windthrow; commercial-fishing operations; recreational activities; illegal shooting; and pollution.

Routine noise and activity and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Gulf of Alaska, Cook Inlet, and the Bering Sea could impact the eagle population adversely. Oil spills are expected to result in lethal effects if they contact habitats where eagles may become oiled or ingest oil by consuming contaminated prey. Transport of future arctic OCS production from the TAP by tanker represents an additional source of oil spills in the Gulf of Alaska. Spill-cleanup operations during the nesting period are expected to cause eagles to abandon the affected areas for at least the season. Eagle distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

Impact of routine noise and activity associated with State oil and gas leases in Cook Inlet is expected to be minimal. A tanker spill in Prince William Sound or northern Gulf of Alaska is expected to cause losses requiring two generations or more for the eagle population to recover. As shown by the *Exxon Valdez* incident, a spill escaping the sound can cause additional losses to the west and south, as could a spill originating in Cook Inlet. Likewise, a tanker spill in the Kodiak to Unimak Pass area is expected to cause losses requiring two generations for recovery and in southeast Alaska, probably three generations or more. Disturbance from oil-spill- containment and cleanup activities is expected to cause abandonment of eagle-nest sites for a variable period and require the equivalent of a generation for recovery to the original population condition.

The impact of losses from other non-OCS factors on the eagle population, including nesting-habitat degradation, commercial fisheries, recreation, shooting, and pollution essentially is unknown but probably is at least equivalent to a generation for recovery.

Routine air-support activity associated with Federal OCS development may disturb small numbers of eagles on the north side of the Alaska Peninsula near Cold Bay (from St. George Basin), in the northern Kodiak archipelago (from Cook Inlet), and in the northeastern gulf (from Gulf of Alaska), but impacts are expected to be minimal and require less than the equivalent of a generation for recovery. Impacts of oil spills (discussed under the base-case scenario) originating from Cook Inlet and Gulf of Alaska lease areas, tankers transporting arctic oil from the TAP, or tankers in the vicinity of Unimak Pass transporting oil from the Navarin and St. George Basins are expected to be similar to those described above, requiring two generations or more for recovery; and in southeast Alaska, probably three generations or more. Impacts from oil-spill-cleanup activities are expected to be as described above, requiring a generation for recovery in local areas.

Impacts of oil spills from non-OCS oil and gas development on bald eagles in Prince William Sound, the northern Gulf of Alaska, or Unimak Pass-eastern Aleutian area are expected to result in losses requiring two generations or more for recovery to the original population condition; in southeast Alaska, three generations or more may be required. Spill-cleanup operations are expected to cause local impacts requiring a generation for recovery. The impact of losses from other non-OCS factors essentially is unknown but probably is at least equivalent to a generation for recovery. Impact of routine disturbance from OCS activity is expected to require less than a generation for recovery. Impact of oil spills and cleanup activities of OCS origin are expected to be similar to those described for non-OCS sources.

CONCLUSIONS: The overall cumulative impact on the Alaskan bald eagle population is expected to require six generations (one generation is a minimum of 5 years) or more for recovery during the 30-year period of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development and oil spills. Two to three generations of this recovery time is due to the proposal.

b) Waterfowl

DIVING DUCKS: Activities that could produce adverse impacts in diving duck populations include routine and accidental activities associated with offshore and onshore oil and gas development on current and future State of Alaska Beaufort Sea and Cook Inlet leases, Canadian Beaufort oil and gas development, transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP, transport of oil from the TAP by tanker to Cook Inlet refineries, transport of Cook Inlet production to Far East markets, offshore mining on State of Alaska leases in Norton Sound, fishing-net entanglement, nesting-habitat disturbance and degradation, predators at nesting colonies, subsistence- and sport-hunting harvests, pollution, and adverse climatic conditions.

Routine noise/activity and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Beaufort, Chukchi, and Bering Seas, and Cook Inlet/Gulf of Alaska could adversely impact diving duck populations. Dredging operations and release of muds and cuttings may alter prey availability in the immediate vicinity of the activity. Oil spills, the primary accidental factor affecting diving ducks, are expected to result in lethal effects if they contact habitats where adult or juvenile birds may become oiled and eggs or chicks oiled through contact with contaminated adults. Contact of a specific population by more than one spill within a short timeframe is expected to extend the period required for recovery. Spill-cleanup operations are expected to cause diving ducks to abandon the affected areas for at least the duration of the activity. Diving duck distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

Routine noise and activity particularly aircraft overflights of and construction-related activities on the coastal plain as well as barrier islands used for nesting and lagoons used during molt and migration, associated with offshore and onshore oil and gas development on current and future State of Alaska Beaufort Sea leases future northeastern Chukchi Sea leases, and Canadian Beaufort oil and gas development, are expected to have localized impacts primarily, such as displacement and decreased productivity, requiring a generation for recovery. Displacement of less abundant species or those that have declined, such as spectacled and Steller's eiders, is expected to cause local losses requiring more than one generation for recovery. Disturbance impacts from similar activities in Cook Inlet are expected to be minimal. Recovery from impacts of non-OCS oil spills in the arctic is expected to require no more than one generation because although large molting and staging populations vulnerable to contact occupy Beaufort and Chukchi lagoons, the probability of a spill entering a lagoon is very low. An oil spill originating from Cook Inlet or a tanker serving the TAP is expected to contact overwintering ducks in lower Cook Inlet, the northeastern Gulf of Alaska, Kodiak Archipelago, and/or along the Alaska Peninsula resulting in losses requiring one or more generations for recovery of abundant species and two generations or more for declining species such as Steller's eider. Similar impacts are expected from a spill in the Unimak Pass area.

Entanglement of diving ducks in fishing nets appears to be a minor factor causing losses requiring less than a generation for recovery, although relevant data is sparse. Predation at nesting colonies or aggregations by mammals (e.g., fox predation on common eider) is expected to result in local losses requiring recovery periods of a generation or more, but overall population effect is expected to require less than a generation. Nesting habitat degradation in general does not appear to be resulting in substantial losses in Alaska, and thus is expected to require less than the equivalent of a generation for recovery; however, increasing recreational use and land development on the Yukon-Kuskokwim Delta and the arctic coastal plain can be expected to elevate disturbance and habitat destruction to levels requiring a generation or more for population recovery. Losses from the impact of pollutants such as pesticides and PCB's are not well documented at the population level but do not appear to be a major problem in Alaska, although mercury used in offshore mining could produce as yet undetermined impacts. Impact of the current Alaskan subsistence harvest of eggs and adult birds on the populations, as well as sport hunting, is difficult to determine but is expected to require a generation or less for recovery of most species and probably a generation or more for those with small and/or declining populations.

Recovery from impacts of routine air- and vessel-support activities in Beaufort and Chukchi Sea lagoons, St. Matthew polynya, Unimak Pass, Kodiak Island area, Cook Inlet, and northeastern Gulf of Alaska associated with Federal OCS development is not expected to require more than one generation because of the small proportion of the populations likely to be exposed and the temporary nature of most effects. Likewise, impacts of pipeline-dredging operations, and release of muds and cuttings on food organisms and resulting losses are expected to require less than one generation for recovery because only a small proportion of available benthic foraging habitat used by diving ducks would be affected. Because the probability of an oil spill occurring and contacting most coastal areas in the Alaska Region occupied by diving ducks during winter or spring and fall migration periods is extremely low, and most of their populations have a substantial reproductive potential, recovery from impacts of OCS oil spills is expected to require no more than one generation. However, throughout the Gulf of Alaska to the Unimak Pass area and eastern Aleutians, losses resulting from oil spills requiring one or more generation for recovery are expected; declining species such as the Steller's eider are expected to require two or more generations. Impacts from oil spills in the spring-lead system of the Chukchi Sea or the St. Matthew Island polynya, where large concentrations of ducks may occur, are expected to require one generation or more for recovery. The potential for populations being contacted by more than one spill within a relatively short timeframe, especially in the Gulf of Alaska area, is expected to extend the expected recovery period. Impact of oil-spill-cleanup operations, especially if pursued over more than one season, is expected to require up to a generation for recovery.

Routine and accidental impacts of non-OCS oil and gas development on diving ducks are expected to result in losses requiring no more than one generation for recovery except in declining populations such as spectacled and Steller's eiders, where more than one generation may be required. Losses resulting from oil spills in the Gulf of Alaska to Unimak Pass and the eastern Aleutians are expected to require one or more generations for recovery and two or more for declining populations, particularly for the spectacled eider if they are concentrated and contacted at their unknown wintering area. Losses from net entanglement are expected to require less than one generation for recovery. Recovery of populations from losses due to predators is expected to require less than a generation. Nesting-habitat degradation is expected to require less than the equivalent of a generation for recovery; however, in areas of increasing development and activity, a generation or more can be required for recovery. Impacts from pollutants other than oil in Alaska are unknown. Subsistence and sport harvests of most species of diving ducks in Alaska is expected to require a generation or less for recovery and a generation or more for those with small and/or declining populations. Recovery from routine impacts of OCS oil and gas development is not expected to require more than one generation. Impacts on food organisms from OCS pipeline dredging, release of muds and cuttings, and mining operations are expected to require less than a generation for recovery. Recovery from impact of OCS oil spills in much of coastal Alaska is expected to require no more than one generation; however, losses from spills in the Gulf of Alaska to the eastern Aleutians are expected to require one generation or more. Recovery periods are expected to be extended if a population is contacted by more than one spill within a short time. Impact resulting from oil-spill-cleanup operations is expected to require up to one generation for recovery.

CONCLUSION: Overall cumulative impact on diving duck populations is expected to require four generations or more (2 to 4 years per generation) for recovery from estimated factors during the 30-year period of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development and subsistence- and sport-hunting harvests. Up to two generations of this recovery time is due to the proposal.

GEESE: Activities that could produce adverse impacts in goose populations include routine and accidental activities associated with offshore and onshore oil and gas development on current and future State of Alaska Beaufort Sea and Cook Inlet leases, Canadian Beaufort oil and gas development, transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP, transport of oil from the TAP by tanker to Cook Inlet refineries, transport of Cook Inlet production to Far East markets, nesting-habitat disturbance and degradation, predators at nesting colonies, subsistence- and sport-hunting harvests, pollution, and adverse climatic conditions.

Routine noise/activity and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Beaufort, Chukchi, and Bering Seas and Cook Inlet/Gulf of Alaska could adversely impact goose populations. Oil spills, the primary accidental factor affecting geese, are expected to result in lethal effects if they contact habitats where adult or juvenile birds may become oiled and eggs or chicks oiled through contact with contaminated adults. Contact of a specific population by more than one spill within a short timeframe is expected to extend the period required for recovery. Spill-cleanup operations are expected to cause geese to abandon the affected areas for at least the duration of the activity. Goose distribution and abundance may be altered if food availability and/or quality decreases in the vicinity of an oil spill.

Routine noise and activity associated with offshore and onshore oil and gas development on current and future State of Alaska Beaufort Sea leases, future northeastern Chukchi Sea leases, and similar activities in Canada, are expected to cause localized displacement and decreased productivity of geese breeding on the coastal plain and barrier islands, as well as those using lagoons during molt and migration, requiring no more than a generation for recovery. Displacement of species that have declined recently and are especially sensitive, such as black brant, is expected to cause local losses requiring more than one generation for recovery. Disturbance impacts from similar activities in Cook Inlet are expected to require less than one generation for recovery. Recovery from impacts of non-OCS oil spills in the Arctic is expected to require no more than one generation because although molting and staging populations vulnerable to contact occupy Beaufort and Chukchi lagoons, the probability of a spill entering any lagoon is very low. An oil spill originating from Cook Inlet or a tanker serving the TAP is expected to contact wintering, migrating, and/or breeding geese in lower Cook Inlet, the northern Gulf of Alaska, the Kodiak Archipelago, and/or along the Alaska Peninsula resulting in losses requiring one or more generations for recovery of abundant species; two generations or more would be required for less abundant or declining species such as emperor, tule, and dusky geese. Similar impacts are expected from a spill in the Unimak Pass area from contact with emperor geese and in southeast Alaska or coastal areas farther south during migration periods.

Nesting-habitat degradation in general does not appear to be resulting in substantial losses in Alaska, and thus is expected to require less than the equivalent of a generation for recovery; however, increasing recreational use and land development on the Yukon-Kuskokwim Delta and the arctic coastal plain can be expected to elevate disturbance and habitat destruction to levels requiring a generation or more for population recovery in the future. Degradation of winter habitat in Washington, Oregon, California, and probably Mexico have substantially reduced the carrying capacity of traditionally used areas. The return of many of these areas to their quality of several decades ago is not anticipated; however, reclamation or preservation of alternate habitats is expected to increase the regional carrying capacity for wintering geese. Predation at nesting colonies or aggregations of some species by mammals (e.g., fox predation on brant, bear on dusky Canada) is expected to result in losses requiring recovery periods of a generation or more for more abundant species and two generations or more for less abundant or declining species. Losses from the impact of pollutants such as pesticides and PCB's are not well documented at the population level but do not appear to be a major problem in Alaska. Impact of the Alaskan subsistence harvest of eggs and adult birds (primarily on the Yukon Delta), as well as sport hunting in Alaska and the lower 48, have been major contributing factors to declining goose populations prior to institution of the Y-K Delta Goose Management Plan. The current take is expected to require a generation or less for recovery of most species, probably a generation or more for those with small and/or declining populations.

Recovery of goose populations from impacts of routine air- and vessel-support activities in Beaufort and Chukchi Sea lagoons, Unimak Pass, Kodiak Island area, Cook Inlet, and northern Gulf of Alaska, associated with Federal OCS development are not expected to require more than one generation because of the small proportion of the populations likely to be exposed and the temporary nature of most effects. Displacement of species that have declined, such as black brant, is expected to cause local losses requiring more than one generation for recovery. Recovery from impacts of OCS oil spills in much of coastal Alaska is expected to require no more than one generation because although molting and staging populations vulnerable to contact occupy Beaufort, Chukchi, and Bering Sea lagoons, the probability of a spill entering any lagoon is very low. An oil spill originating from Cook Inlet or a tanker serving the TAP is expected to contact wintering, migrating, and/or breeding geese in lower Cook Inlet, the northern Gulf of Alaska, the Kodiak Archipelago, and/or along the Alaska Peninsula resulting in losses requiring one or more generations for recovery of abundant species and two generations or more for less abundant or declining species such as emperor, tule, and dusky geese. Similar impacts are expected from a spill in the Unimak Pass-eastern Aleutians area from contact with emperor geese and in southeast Alaska or coastal areas farther south during migration periods. The potential for populations being contacted by more than one spill within a relatively short timeframe, especially in the Gulf of Alaska area, is expected to extend the expected recovery period. Impact of oil-spill-cleanup operations, especially if pursued over more than one season, is expected to require up to a generation for recovery.

Routine and accidental impacts of non-OCS oil and gas development on geese in arctic habitats are expected to result in losses requiring no more than one generation for recovery, except in recently declining populations such as black brant, for which more than one generation may be required. Losses resulting from oil spills in Cook Inlet and the Gulf of Alaska to the Unimak Pass-eastern Aleutian area and southeast Alaska are expected to require one or more generations for recovery of abundant species and two or more for less abundant or declining species. Nesting-habitat degradation is expected to require less than the equivalent of a generation for recovery; however, in areas of increasing development and activity, a generation or more can be required for recovery. Degradation of winter habitat in the lower 48 has decreased the carrying capacity of the winter range; recovery is not anticipated unless alternate areas become available. Recovery of populations from losses due to predators is expected to require a generation or more for some abundant species and two generations or more for less abundant or declining species. Subsistence harvest in Alaska as well as the sport harvest in Alaska and the lower 48, have been major factors contributing to declining goose populations on the Y-K Delta. The current harvest is expected to require a generation or less for recovery of most populations and a generation or more for those with small and/or declining populations. Recovery from routine impacts of OCS oil and gas development is not expected to require more than one generation. Displacement of species that have declined is expected to cause local losses requiring more than one generation for recovery. Recovery from impacts of OCS oil spills in Beaufort, Chukchi, and Bering Sea coastal areas is expected to require no more than one generation; however, losses from spills in Cook Inlet or the Gulf of Alaska to the eastern Aleutians and southeast Alaska are expected to require one or more generations for recovery of abundant species, two generations or more for less abundant or declining species. Similar impacts are expected to result from oil spills in coastal areas farther south during migration periods. Recovery periods are expected to be extended if a population is contacted by more than one spill within a short time. Impact of oil-spill-cleanup operations is expected to require up to one generation for recovery.

CONCLUSION: Overall cumulative impact on goose populations is expected to require five generations or more (3 years per generation) for recovery from estimated factors during the 30-year period of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development, subsistence and sport harvests, and winter habitat degradation. About two generations of this recovery time is due to the proposal.

(c) Pacific Region

1) Threatened or Endangered Species

a) Bald Eagle (Pacific Population)

Impacts to bald eagles in the Pacific OCS Region may result from ongoing projects which may be unrelated and/or predate the proposed action. Even without the proposed action, bald eagles are subject to man-induced stresses superimposed upon unpredictable natural fluctuations in population sizes. Most major activities not associated with the proposed action that may impact bald eagles, including non-OCS oil spills, are discussed in Section IV.D.1.c. Other non-OCS impacts to bald eagles include DDT, shooting, disturbance, and habitat loss. Potential OCS-related cumulative impacts to eagles include vessel and air traffic, and accidental oil spills.

In the recent past, one of the more significant impacts to bald eagle populations was caused by the bioaccumulation of DDT (or its metabolite DDE). This disrupted calcium metabolism and resulted in the birds laying eggs with unusually thin shells leading to low egg survival. From 1947 to 1972 throughout the lower 48 states, eagle reproductive success dropped and remained at low levels until DDT was banned (Hickey and Anderson, 1968). This species is still recovering from those previous lows (Grier 1982).

Currently, the most adverse of these impacting agents affecting bald eagles are shooting, disturbance, and habitat loss. In the early 1960's, shooting was the cause of death for 60 percent of the dead eagles found, although in recent years the percentage has dropped to 18 percent.

Disturbance may result from the presence of people, vehicles, boats, or aircraft in the vicinity of a nest site. Disturbance prior to nesting may prevent a nest site from being occupied, while disturbance after nesting has commenced may cause a site to be abandoned.

Destruction of nesting habitat has also had adverse impacts on eagle numbers. Since eagles prefer nesting and wintering areas located near water, they often come into conflict with people. Destruction of nesting areas are not immediately obvious. As the result of being forced to use less favorable habitat or of poorer quality, eagles are more susceptible to adverse factors such as lack of food, and roosting sites, shootings, electrocutions, and injuries.

As indicated in the base-case analysis (Section IV.D.1.a(5)), impacts from OCS-related routine oil and gas activities are limited to those that can occur in close proximity to the shoreline, including helicopter traffic, pipeline landfalls, and construction of onshore support facilities. In the Southern California Planning area existing, projected, and proposed OCS-related routine oil and gas activities are not expected to have an impact on bald eagles because of the extreme rarity of the species along the southern California coast.

Bald eagles are vulnerable to oil spill effects. Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on bald eagle populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, assumed, and proposed OCS activities in the Alaska and Pacific OCS Regions.

It is assumed that during the next 35 years, 6 oil spills will occur somewhere in the Southern California Planning Area as a result of TAPS and imports. These spills, in addition to the pipeline and Alaskan tanker spill assumed for the base case, are not expected to have an impact on bald eagles because of the extreme rarity of this species along the southern California coast. For the same reason, TAPS-, imports-, and OCS-related spills off central California are also not expected to impact bald eagle populations.

During the next 35 years, four tanker-related oil spills are assumed to occur along the Washington coast. Two of these spills are assumed to result from TAPS, one from imports, and one from Alaska tankering as a result of this proposal. Given that the distribution of these oil spills over time cannot be estimated, it is assumed for analytical purposes that these spills will be uniformly distributed over a 35 year period.

About 60-70 pairs of eagles occurs year-round along the Washington coast, and a portion of this population could potentially be at risk from a tanker spill. If a tanker spill were to contact the Washington shore or if marine birds and/or mammals were oiled and washed ashore, some eagles could be oiled and mortality could occur. The magnitude of expected eagle mortality would vary with a number of factors, including time of year, volume of oil spilled, wind speed and direction, current speed and direction, distance of spill from shore, and location of spill in relation to eagle populations. Given the analytical assumptions for the cumulative case, tens of eagles are expected to be lost as a consequence of a spill contacting the Washington coast. Because of the relatively slow population growth rates of bald eagles, recovery in this area could take up to 4 years. Although not expected, if these spills occur at a greater frequency (within 1 to 4 years of the first oil spill) the depressed population as a result of the first oil spill would not have fully recovered prior to the second oil spill, thereby resulting in an increase in the level of impact.

In addition to these spills, a 30,000 bbl tanker spill along the Oregon coast is assumed as a result of existing leases in the Alaska OCS Region. This spill is not expected to have an impact on bald eagles along the Oregon coast because of its assumed distance from shore (50 miles).

CONCLUSION: Non-OCS impacts to bald eagles, including DDT, shooting, disturbance, and habitat loss, have reduced populations to very low levels throughout much of the species' range in the lower 48 States. Although these impacts are expected to continue to have an effect on this species, based on recent trends, bald eagle populations in the Pacific Northwest and northern California are expected to increase slowly over the life of the proposal. However, these impacts have effectively eliminated this species from the coast of central and southern California, and bald eagles are not expected to return to those areas because of the continued and ever-increasing levels of human activity. Routine OCS activities, which are concentrated in the Southern California Planning Area, are not expected to have an impact on bald eagles because of the extreme rarity of this species in that area.

b) California Least Tern

Impacts to California least terns may result from ongoing projects which may be unrelated and/or predate the proposed action. Even without the proposed action, California least terns are subject to man-induced stresses superimposed upon (and possibly reinforcing) unpredictable natural fluctuations in population sizes. Most major activities not associated with the proposed action that may impact least terns, including non-OCS oil spills, are discussed in Section IV.D.1.c. Other non-OCS impacts to least terns include disturbance and predation. Potential OCS-related cumulative impacts to terns include air traffic, pipeline landfalls, and accidental oil spills.

The most significant impacting agent affecting California least tern populations is the destruction of nesting and feeding habitat due to the development of the southern and central California coastline (see Section IV.D.1.c for a discussion of loss of coastal habitat in California). Coastal highway construction, recreational development, and construction of beach cottages have reduced habitat and permitted increased human access to least tern nesting beaches. Feeding areas (estuaries, coastal ponds and marshes) have been filled in, developed, and polluted. The continued loss of shoreside nesting and feeding habitat, along with high levels of human disturbance and predation by coyotes, foxes, and domestic animals at the remaining colonies, have been responsible for the dramatic decline in numbers. It is unknown what impacts least terns are experiencing in Mexican waters during the nonbreeding season, but exposure to pesticides is a distinct possibility.

As indicated in the base-case analysis (Section IV.D.1.a(5)), impacts from OCS-related routine oil and gas activities are limited to those that can occur in close proximity to the shoreline, including helicopter traffic, pipeline landfalls, and construction of onshore support facilities. Very few pipeline landfalls and onshore support facilities have been developed in the Southern California Planning Area as a result of either State or Federal leasing programs, and only one future pipeline landfall is expected to result from existing Federal leases. The impact of construction on least terns could be severe if the activity was in close proximity to a breeding colony during the period when terns are present (May-September). However, this is considered unlikely, as existing legislative constraints and permitting procedures would prevent such an occurrence. Thus, the impact of construction on least terns is limited to the temporary (seasonal) displacement of terns from foraging areas immediately adjacent to the activity. Compared to the effects of non-OCS impacting agents on least terns, the impact of OCS-related past, present, and future construction of pipeline landfalls and support facilities is considered negligible.

Like most avian species, least terns are vulnerable to oil spills (see Sections IV.A and IV.D.1.b(5)). Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on least terns populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific OCS Regions.

In addition to the pipeline and Alaskan tanker spill assumed for the analysis of the proposed action, it is assumed that during the next 35 years, 6 oil spills of 30,000 bbl, will occur somewhere in the Southern California Planning Area as a result of TAPS and imports. Given that the distribution of these oil spills over time cannot be estimated, it is assumed for analytical purposes that these spills will be uniformly distributed over a 35 year period. Effects on terns would be as described for the base case (Section IV.D.1.a(5)). However, cumulative effects on the tern population could be greater, because more spills are expected and more individuals are likely to be contacted.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the 35-year life of the proposed action (see Table IV.D.1.c-6). These small oil spills are not expected to have an impact on terns because the proposed platforms, where small spills will originate, are located at least 3 miles from shore, and the dispersion and weathering of a small spill should prevent it from contacting breeding colonies.

CONCLUSION: Non-OCS impacts to least terns, including coastal development, disturbance, and predation, have greatly reduced their numbers. Although the tern population has grown significantly since the mid-1970's, these impacts will most likely increase, and during the 35-year life of this proposal the tern population is expected to remain at the current depressed level or increase somewhat (10-20%). Cumulative impacts of routine OCS activities on least terns are expected to be negligible. The cumulative impacts of accidental oil spills mainly from non-OCS sources are expected to contribute to the continued depressed status of this species, although not to the same degree as coastal development, disturbance, predation. Expected outcome of spill contact with a tern colony are loss of up to 50 pairs (5% of population) and the complete disruption of the colony's reproductive cycle for that year. Recovery from the assumed OCS and non-OCS oil spills is expected to take 2-4 years.

c) California Brown Pelican

Impacts to California brown pelicans may result from ongoing projects which may be unrelated and/or predate the proposed action. Even without the proposed action, brown pelicans are subject to man-induced stresses superimposed upon (and possibly reinforcing) unpredictable natural fluctuations in population sizes. Most major activities not associated with the proposed action which may impact brown pelicans, including non-OCS oil spills, are discussed in Section IV.D.1.c. Potential OCS-related cumulative impacts to pelicans include vessel and air traffic, platform and pipeline construction, platform removal, and accidental oil spills.

The major cause of the dramatic decline of the California brown pelican during the mid-1960's and early 1970's was the bioaccumulation of chlorinated hydrocarbons (DDT, DDE, Dieldrin, and endrin). After the dumping of chlorinated hydrocarbons into the waters off southern California was terminated in the early 1970's, pelican reproduction began to improve (Anderson et al., 1975).

Since California brown pelican breeding colonies are protected in the U.S. (on Anacapa and Santa Barbara Islands), the major potential impacting agents to this species are naturally occurring fluctuations in prey species and large oil spills. A few foraging or resting pelicans could be disturbed by the noise and activity associated with existing and proposed OCS exploration and development, but these impacts are expected to be limited to a temporary displacement from the immediate vicinity of the disturbance.

California brown pelican population size and productivity have historically oscillated in relation to naturally occurring environmental changes. These oscillations correspond with fluctuations in prey species which in turn appear to be related to cyclical changes in water temperatures off southern California. These environmental changes are expected to continue in the future, and may be responsible for major fluctuations in pelican population size.

Like most avian species, California brown pelicans are vulnerable to the effects of oil spills (see Section IV.A and IV.D.1.a(5)). Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on California brown pelican populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific OCS Regions.

In addition to the pipeline and Alaskan tanker spill assumed for this proposal under the proposed action, it is assumed that in the next 35 years, 6 oil spills of 30,000 bbl, will occur somewhere in the Southern California Planning Area as a result of TAPS and imports. Outside of the Southern California Planning Area, five non-OCS tanker oil spills are assumed to occur in the Pacific OCS Region during the next 35 years, in addition to the four tanker spills assumed for the base case. Given that the distribution of these oil spills over time cannot be estimated, it is assumed for analytical purposes that these spills will be uniformly distributed over a 35 year period. Effects on pelicans would be as described for the base case (Section IV.D.1.a(5)). However, cumulative effects on the pelican population could be greater, because more spills are expected and more individuals are likely to be contacted.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). These small oil spills are not expected to have an impact on California brown pelicans because the proposed platforms, where small spills will originate, are located at least 3 miles from shore (6 mi from breeding colonies), and the dispersion and weathering of a small spill should prevent it from contacting breeding colonies or roosts.

CONCLUSION: The dramatic decline in the SCB pelican breeding population was caused by the bioaccumulation of chlorinated hydrocarbons which was probably exacerbated by food scarcity. The number of breeding pairs has increased significantly since the early 1970's, although they have not yet reoccupied some of the breeding sites that were used prior to the decline. Currently, the major potential impacting agents to this species are naturally occurring fluctuations in prey species and large oil spills. Accidental oil spills, mainly from non-OCS sources, are expected to result in pelican mortality and reproductive losses. During the non-breeding season, from 50 to 500 pelicans are expected to be oiled, with mortality occurring in 20 to 50 percent of those contacted; recovery is expected in 1 to 2 years. During the breeding season from hundreds to as many as 1,000 pelicans are expected to be oiled, with mortality occurring in 20 to 50 percent of those contacted; recovery is expected in 2 to 4 years.

d) Light-Footed Clapper Rail

Impacts to light-footed clapper rails may result from ongoing projects which may be unrelated and/or predate the proposed action. Even without the proposed action, rails are subject to man-induced stresses superimposed upon (and possibly reinforcing) unpredictable natural fluctuations in population sizes. Most major activities not associated with the proposed action that may impact light-footed clapper rails, including non-OCS oil spills, are discussed in Section IV.D.1.c. Potential OCS-related cumulative impacts to rails include air traffic, pipeline landfalls, construction of onshore support facilities, and accidental oil spills.

The most significant impacting agent affecting light-footed clapper rail populations is the destruction of nesting and feeding habitat due to the development of the southern and central California coastline (see Section IV.D.1.c for a discussion of loss of coastal habitat in California). The habitat of this species is restricted to coastal salt marshes from Santa Barbara, California, south to San Quintin Bay, Baja California, Mexico. These coastal salt marshes have been heavily impacted, and less than one-third of an estimated 26,000 acres (10,500 ha) of salt marsh habitat remains between Santa Barbara and the Mexican border.

As indicated in the base-case analysis (Section IV.D.1.a(5)), impacts from OCS-related routine oil and gas activities are limited to those that can occur in close proximity to the shoreline, including helicopter traffic, pipeline landfalls, and construction of onshore support facilities. Very few pipeline landfalls and onshore support facilities have been developed in the Southern California Planning Area as a result of either State or Federal leasing programs, and only one future pipeline landfall is expected to result from existing Federal leases. The impact of construction on rails could be severe if the activity was in close proximity to a salt marsh nesting area. However, this is considered unlikely, as existing legislative constraints and permitting procedures would prevent such an occurrence.

Like most avian species, light-footed clapper rails are vulnerable to oil spills (see Section IV.A and IV.D.1.a(5)). Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on rail populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific OCS Regions.

In addition to the pipeline and Alaskan tanker spill assumed for this proposal under the base case, it is assumed that in the next 35 years, 6 oil spills of 30,000 bbl, will occur somewhere in the Southern California Planning Area as a result of TAP and imports. Given that the distribution of these oil spills over time cannot be estimated, it is assumed for analytical purposes that these spills will be uniformly distributed over a 35 year period. Effects on light-footed clapper rails would be as described for the base case (Section IV.D.1.a(5)). However, cumulative effects on the rail population could be greater, because more spills are expected and more individuals are likely to be contacted.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). These small oil spills are not expected to have an impact on light-footed clapper rails because the proposed platforms, where small spills will originate, are located at least 3 miles from shore, and the dispersion and weathering of a small spill should prevent it from contacting this species habitat.

CONCLUSION: Destruction of its coastal salt marsh habitat has greatly reduced the numbers of light-footed clapper rails. The pressures on the species' habitat is expected to continue, and no new habitat is likely to become available, therefore, the species is expected to remain at its current depressed level or decline somewhat (10-20%). The cumulative impacts of OCS-related activities and accidental oil spills from both OCS and non-OCS sources are not expected to alter the status of this species.

2) Nonendangered Species

a) Seabirds

Activities that could produce adverse impacts in seabird populations include routine and accidental activities associated with offshore and onshore oil and gas development on current and future State of Alaska Beaufort Sea and Cook Inlet leases, Canadian Beaufort oil and gas development, transport of current and future State of Alaska arctic production by tanker through Prince William Sound and the Gulf of Alaska from the TAP, transport of oil from the TAP by tanker to Cook Inlet refineries, transport of Cook Inlet production to Far East markets, commercial-fishing operations, nesting-habitat degradation, predators at nesting colonies, subsistence-harvest activities, recreational activities, pollution, and adverse climatic conditions.

Routine noise/activity and oil spills (discussed under the base-case scenario) associated with future oil and gas development on Federal leases in the Beaufort, Chukchi, and Bering Seas, and Cook Inlet/Gulf of Alaska could adversely impact seabird populations. Dredging operations and release of muds and cuttings may alter prey availability in the immediate vicinity of the activity. Oil spills, the primary accidental factor affecting seabirds, are expected to result in lethal effects if they contact habitats where adult or juvenile birds may become oiled and eggs or chicks oiled through contact with contaminated adults. Contact of a specific population by more than one spill within a short timeframe is expected to extend the period required for recovery. Spill-cleanup operations are expected to cause seabirds to abandon the affected areas at least for the duration of the activity. The OCS mining operations may release substances that are toxic to seabirds or their prey. Seabird distribution and abundance may be altered if prey availability decreases in the vicinity of an oil spill.

Routine noise and activity, particularly aircraft overflights of and construction-related activities on barrier islands used for nesting, associated with offshore oil and gas development on current and future State of Alaska Beaufort Sea leases, future northeastern Chukchi Sea leases and Canadian Beaufort oil and gas development are expected to have extremely localized impacts, such as displacement and decreased productivity, requiring a generation or less for recovery. Overall population impacts are expected to be minimal. Disturbance impacts from similar activities in Cook Inlet also are expected to be minimal. Recovery from impacts of oil spills in the arctic is not expected to require more than one generation, except possibly for the black guillemot, which has an extremely limited breeding range in Alaska, because of the small proportion of the populations likely to be contacted (Beaufort and Chukchi barrier islands). An oil spill originating from Cook Inlet or a tanker serving the TAP is expected to contact colonies in lower Cook Inlet, the northeastern Gulf of Alaska, Kodiak Archipelago and along the Alaska Peninsula resulting in losses requiring two generations or more for recovery, especially among the alcids. Similar impacts are expected from a spill in the Unimak Pass area.

Commercial-fishing operations may cause adverse effects by altering prey availability, expected to require no more than the equivalent of one generation for recovery; but the most serious impact is from net-entanglement mortality (reported to be 500,000 individuals or more annually in Alaska). Recovery from this level of mortality is not expected until losses are decreased substantially. Interaction with other forms of marine debris contributes to this mortality. Recovery in California, where losses from net mortality also are high, is expected to require two generations or more. Predation at colonies by mammals introduced onto islands, or naturally-occurring rodents, results in losses requiring recovery periods that may range from less than a generation where access to nesting areas is limited to no recovery until the predators are removed. Nesting- habitat degradation in general does not appear to be causing substantial losses in Alaska, and thus is expected to require less than the equivalent of a generation for recovery; however, impact of timber harvesting in southeast Alaska on marbled murrelet nesting is unknown but expected to require the equivalent of two generations or more for recovery. Impacts in California, with its greater developmental pressure, is expected to require the equivalent of several generations for recovery. Losses from the impact of pollutants such as pesticides and PCB's were substantial in California (e.g., brown pelican) prior to regulations controlling their disposal; populations in that region still are recovering after several generations. Pollutants other than oil do not appear to be a major problem in Alaska, although mercury used in offshore mining could produce as yet undetermined impacts in Norton Sound colonies. Impact of the current Alaskan subsistence harvest, eggs and small numbers of adult birds, on the populations is not known but is expected to require less than a generation for recovery. Potential impact of recreational activities is unknown, but overall is expected to require less than the equivalent of a generation for recovery. Adverse climatic conditions, such as El Niño warming events, can cause major impacts on seabird populations, particularly surface-feeding species at the lower latitudes, requiring several generations for recovery. The interaction of such events with other factors is unknown. In Alaska, such events appear to have had an adverse effect in some areas, but the data are equivocal.

Recovery from impacts of routine air- and vessel-support activities associated with Federal OCS development (in the Beaufort Sea; at St. Matthew, the Pribilof, and Kodiak Islands; in Unimak Pass) are not expected to require more than one generation because of the small proportion of the populations likely to be exposed and the temporary nature of most effects. Likewise, pipeline-dredging operations and OCS mining are expected to require less than one generation for recovery because only a small proportion of the seabird populations would be disturbed. Recovery from impacts of oil spills in the Bering Sea or Gulf of Alaska is expected to require two or more generations because of the potential for contacting major colonies or colony areas. The potential for contacting colonies by more than one spill within a relatively short timeframe could extend the expected recovery period; however, this is primarily expected to occur in the Gulf of Alaska. Impact of oil-spill-cleanup operations, especially if pursued over more than one season, is expected to require up to a generation for recovery.

Routine and accidental (arctic only) impacts of non-OCS oil and gas development on seabirds are expected to result in losses requiring no more than one generation for recovery. Losses resulting from oil spills in the Gulf of Alaska to Unimak Pass and the eastern Aleutians are expected to require two or more generations for recovery. Commercial-fishing operations are not expected to require more than one generation for recovery; but recovery from net-entanglement mortality is not expected until losses decline substantially. Recovery from losses due to introduced predators is expected to be variable depending on circumstances. Nesting-habitat degradation, except possibly for the marbled murrelet, is expected to require less than the equivalent of a generation for recovery in Alaska. In California, it is expected to require the equivalent of several generations. Impacts from pollutants other than oil in Alaska are unknown; in California, populations are still recovering after several generations. Subsistence harvest of seabirds in Alaska is expected to require less than a generation for recovery. Adverse climatic events are expected to require several generations for recovery. Recovery from routine impacts of OCS oil and gas development is not expected to require more than one generation. The OCS pipeline dredging and mining operations are expected to require less than a generation for recovery. Recovery from impact of OCS oil spills in the Arctic is expected to require no more than one generation, whereas losses from spills in the Bering Sea or Gulf of Alaska are expected to require two generations or more. Recovery periods are expected to be extended if a population is contacted by more than one spill within a short time. Impact resulting from oil-spill-cleanup operations is expected to require up to one generation for recovery.

CONCLUSIONS: Overall cumulative impact on seabird populations is expected to require six generations or more for recovery from estimated factors during the 30-year period of the proposal. Principal components of this impact are non-OCS and OCS oil and gas development. Recovery from net-entanglement mortality is not expected to occur until losses decline substantially.

b) Shorebirds

Impacts to shorebirds may result from ongoing projects which may be unrelated and/or predate the proposed action. Even without the proposed action, shorebirds are subject to man-induced stresses superimposed upon unpredictable natural fluctuations in population sizes. Most major activities not associated with the proposed action that may impact shorebirds, including non-OCS oil spills, are discussed in Section IV.D.1.c. Potential OCS-related cumulative impacts to shorebirds include air traffic, pipeline landfalls, and accidental oil spills.

Past and present non-oil related impacts on shorebirds include hunting and habitat loss. During the late 1800's and early 1900's shorebirds were legally hunted for their plumage on a massive scale throughout North America. Some populations were estimated to have been reduced by 50 to 95 percent. Plumage hunting was outlawed from 1900 to 1920, and most shorebirds are believed to have recovered, although the degree of recovery is unknown (Harrington, 1986).

Currently, adverse impacts to most shorebirds come primarily from the loss of winter and migratory habitat due to coastal development. As mentioned in Section III.C.2, shorebirds concentrate in large numbers on staging areas during their annual migrations. While on the staging area, birds feed intensively to store up fat which is used to "fuel" their subsequent non-stop flight to the next staging area, which in some cases can be thousands of miles apart separated by unsuitable habitat (Odum et al., 1961; Senner, 1979). For this reason it is believed that these staging areas are critical to shorebirds and that their loss could result in reduced population numbers through starvation on wintering grounds. Loss of coastal wetland habitat to commercial and residential development is nowhere more evident in the Alaska and Pacific OCS Regions, than in California. Speth (1979) reported that the State of California has lost some 261,000 acres (almost 70%) of its coastal wetlands since the early 1900's to a variety of coastal development projects. With human population growth expected to increase, at best there could be no further net loss of habitat for migrating shorebirds over the 35-year life of the proposal.

As indicated in the base-case analysis (Section IV.D.1.a(5)), impacts from OCS-related routine oil and gas activities are limited to those that can occur in close proximity to the shoreline, including helicopter traffic, pipeline landfalls, and construction of onshore support facilities. Shorebirds are most vulnerable on their breeding grounds, where disturbances can cause reductions in productivity. On their wintering grounds, the impact of disturbance is generally limited to the temporary (i.e., a few hours to a few weeks depending on the source and nature of the disturbance) disruption of normal shorebird behavior and possible displacement from the immediate vicinity of the disturbance. In the Southern California Planning Area, a shorebird wintering area, the level of activity associated with existing, projected, and proposed OCS oil and gas development has been relatively limited. Currently, there are 31 platforms in Federal and State waters off southern California, with an additional

10 projected platforms and the 7 platforms assumed for the base-case scenario, a combined total of 48. The number of standing platforms is not expected to actually reach that level as 21 platforms are assumed to be removed during the 35-year life of this proposal. Very few pipeline landfalls and onshore support facilities have been developed in the Southern California Planning Area as a result of either State or Federal leasing programs, and only one future pipeline landfall is expected to result from existing Federal leases. The impacts to wintering shorebirds from this level of activity would constitute only a minor portion of the total level of disturbance they are subjected to including that from non-OCS impacting agents.

The vast majority of shorebirds found along the Pacific coast of North America nest in Alaska, and disturbances in this area could cause higher impacts than in southern California. However, the level of disturbance associated with existing, projected, and proposed OCS oil and gas development is much less than in southern California. In the Alaska Region, there currently is no oil and gas development or production activities in Federal OCS waters, although producing offshore leases do exist in State waters in the Cook Inlet and Beaufort Sea. The cumulative-case scenario for the Alaska Region assumes the existence of 21 platforms in OCS waters over the 30-year life of the proposed action. The number of platform removals expected during this period has not been estimated. Eighteen of these platforms are expected to be located in the Arctic and Bering Sea Subregions. Five pipeline landfalls are also assumed. The impacts to nesting shorebirds from this level of activity would constitute only a minor portion of the total level of disturbance they are subjected to including that from non-OCS impacting agents.

Like most avian species, shorebirds are vulnerable to oil spills, although apparently to a lesser degree than seabirds (see Section IV.A and IV.D.1.a(5)). Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on shorebird populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific OCS Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under (Section IV.D.1.c(3)), Pacific Marine Mammals, Threatened and Endangered Cetaceans . That description includes assumptions regarding oil spill occurrence, source, and size.

Since shorebirds migrate through nearly all the planning areas in the Alaska and Pacific Regions, they could be affected by a number of these spills. Effects on shorebirds would be as described for the base case (Section IV.D.1.a(5)). However, cumulative effects on shorebirds could be greater, because more spills are expected and more individuals are likely to be contacted. As described in the base case, if a spill were to occur and contact shorebird habitat, it would be expected to result in the loss of a few to several hundred individuals.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). In the Alaska Region, it is assumed that as many as 1,938 oil spills of 1-50 bbl and 79 spills of 50-999 bbl will occur over the 35-year life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the spills discussed above, and are not expected to make a measurable contribution to impacts on shorebirds.

In summary, although specific information on the status of most shorebirds is not available, it is generally believed that most species have recovered substantially from past hunting pressures. However, concern remains over the effect of habitat loss on these birds, and this problem is expected to increase in the future. Therefore, during the life of this proposal shorebird populations are expected to remain at current levels or decline somewhat (10-20%). Cumulative impacts of routine OCS activities on shorebirds are expected to be negligible in the Pacific Region but somewhat higher in the Alaska Region. The impacts of accidental oil spills are expected to include both adult shorebird mortality and reproductive losses, but these spills are not expected to alter the continued stability or slight decline of shorebird populations which is expected to result from continued habitat loss.

CONCLUSION: Although naturally occurring fluctuations in population size are likely, shorebird populations are expected to remain at current levels or decrease slightly (10-20%) during the next 35 years. Loss of wintering and migratory habitat due to coastal development will continue to be the greatest threat to this group. The cumulative impacts of accidental oil spills (both non-OCS and OCS-related) are expected to cause shorebird mortality and reproductive losses, but no changes in numbers or distribution distinguishable from multi-year natural variation in population size are anticipated.

(d) Atlantic Region

1) Threatened or Endangered Species

Three major non-OCS impacts which affect these species are habitat loss, human intrusion, and pollution. The impact-producing factors associated with routine gas and oil activities are limited because of the aerial nature of this resource and the various species' habitat preferences. Topics discussed include noise, aircraft and vessel traffic, offshore structures, lights, mud and cuttings discharges, and pipeline construction. In addition to routine OCS gas and oil impacts, certain endangered and threatened bird resources could possibly be impacted by accidents associated with OCS gas and oil operations. These include impacts due to chronic operational discharges and hydrocarbon spills. Also, non-OCS hydrocarbon spills may also affect these resources due to the tanker transport of imported hydrocarbons.

The number, size, and location of oil spills have been described previously.

Due to the similarities in infrastructures and routine activities between the high case and cumulative scenario, the impacts are expected to be similar (see Section IV.D.1.b(5)). The potential impact-producing factors and their likely effect on endangered and threatened birds are discussed below.

Noise is not expected to result in measurable impacts on endangered and threatened birds. Three of the four species which occur offshore are transient migrants. These are the roseate tern and the peregrine falcon. The distribution and seasonal occurrence of the Bermuda petrel is not well documented, but it is unlikely that this species would be measurably affected by noise from 9 platforms and vessel/aircraft traffic. Similarly, no endangered and threatened bird species' populations are expected to be affected by geophysical survey activities or startle reactions due to vessel or aircraft traffic. In shore areas it is not expected that the piping plover, the peregrine falcon, or bald eagle will be affected by aircraft or vessel traffic or other industrial noises from support operations. These activities are expected to be sited at existing facilities and are not expected to effect endangered or threatened birds.

Discharges for the cumulative scenario will be about 2.3 Mbbl of muds and 0.9 Mbbl of cuttings. Because the species of endangered and threatened birds which occur offshore are primarily engaged in migratory behavior (see Section III.D.2.b) and are highly aerial, it is not expected that muds and cuttings discharges will have any measurable impact on those endangered and threatened species which occur offshore.

Offshore platforms and associated lights have not been demonstrated to affect birds in other OCS areas and, therefore, are not considered a likely source of impacts to those species of endangered and threatened birds which occur offshore on the Atlantic OCS.

Offshore, construction of the pipeline could be contacted by migratory roseate terns, peregrine falcons, and possibly the Bermuda petrel. The routine impact-producing factors associated with this activity are similar to those for platforms, with equivalent impact expectations. The construction of the various gathering lines and trunklines is a relatively short-term project. In inshore waters 60 m (198 ft) and less, the pipeline would be buried, most likely by dredging. This is not expected to produce any measurable impact on endangered or threatened bird populations which occur over coastal waters or shoreline habitat on the mid- and south Atlantic OCS. None of the 4 landfalls are assumed to occur in habitat supporting endangered or threatened birds. No measurable impacts on the population size, distribution, or behavior of endangered or threatened birds are expected due to pipeline construction activities.

Along with the expected impacts associates with routine activities, those species of endangered and threatened birds which occur on the Atlantic OCS or within its coastal habitats will also likely continue to experience impacts from non-OCS gas and oil sources and activities. These include loss or degradation of habitat, human disturbance, and pollution. These impacts essentially occur onshore and not at sea.

The 23 operational spills assumed to occur are not expected to measurably affect endangered and threatened birds. Most operational spills are assumed to occur offshore where the roseate tern, and peregrine falcon are seasonal migrants. These species and the Bermuda petrel are highly aerial or terrestrial, and are not likely to contact oiled waters. Individual birds which may make occasional contact with the water could be stained. Lethal impacts are not expected and no nest contamination is expected to occur. No impacts are expected due to chronic operational spills or the single small spill offshore. Those chronic operational discharges which will occur in inshore waters, most likely at shore facilities, are also not expected to impact endangered and threatened birds, as it is unlikely that piping plovers, peregrine falcons, roseate terns, or bald eagles would occur within industrially developed support facility habitat.

It is not expected that the 9 offshore spills would measurably affect the respective populations of roseate terns, peregrine falcons, or Bermuda petrels for reasons described above (see Section IV.D.1.a(5)). However, spills occurring in port waters could contact bald eagles, piping plovers, peregrine falcons, and roseate terns. Impacts to a few individuals of these species, while possibly measurable locally, would not be expected to discernibly alter the abundance, distribution, or behavior of these species at the population level.

The foraging habitat and behavior of piping plovers makes this species susceptible to staining by oil. Most adults which might be affected would likely experience sublethal impacts. However, developing embryos and chicks are quite susceptible to even minute quantities of oil and these impacts are generally lethal (see Section IV.D.1.a(5)). In addition to direct impacts due to staining or oiling, some temporary loss of foraging habitat could occur. However, such localized impacts are not be expected to measurably affect the abundance, distribution, or behavior of this species.

The scavenging habits of bald eagles are well known. Such behavior, in the event of an oil spill (see Section IV.D.1.a(5))could make a limited number of individuals susceptible to potentially lethal impacts . Depending on the location and time of year, impacts due to nest contamination could occur. The loss of a very few bald eagles, while likely to be a measurable impact within the oil-impacted area, would not be likely to affect the abundance, distribution, or behavior of this species at the population level.

The primary nesting areas of roseate terns are located in the north Atlantic. As no oiling impacts are assumed under the cumulative scenario for this planning area, no impacts on nesting success are expected. A few birds could contact oil were a spill to occur during migration. However, as stated previously, this species is highly aerial and contact with oiled water would most likely result in sublethal impacts (see Section IV.D.1.a(5)). However, were a few individuals to be lethally impacted over the 40-year duration of the scenario, no discernable change in the population size, distribution or behavior of roseate terns due to spilled oil is expected.

The peregrine falcon occurs year-round within mid- and south Atlantic coastal areas and is a regularly observed coastal and offshore migrant. Peregrine falcons could be attracted to lightly to moderately oiled birds but are not thought to prey on or scavenge heavily oiled animals. Consumption of contaminated prey could result in the transfer of some oil to feathers but it is not believed that this would result in lethal impacts, or seriously impair flight. The potential does exist for contamination impacts on chicks. Though it may be possible to determine impacts on a local basis, no measurable changes to the peregrine falcon population as a whole would be expected due to spilled oil.

In summary, the endangered and threatened status of the marine and coastal species discussed in this section are the direct result of prior exploitation and widespread impacts due to habitat losses and chemical contamination. For some species, non-OCS gas and oil activities are still producing impacts. Although no specific impact-producing factors attributable to non-OCS gas and oil activities are documented for endangered and threatened birds in offshore areas, loss of habitat or habitat quality, and chemical impacts are likely to continue into the foreseeable future. However, routine gas and oil activities such as vessel and aircraft traffic, offshore structures, artificial lights, muds and cuttings discharges, and pipeline construction are not expected to affect the population size, distribution, or behavior of these species. OCS gas and oil impacts which could conceivably affect individual endangered and threatened birds either lethally or sublethally on a local basis center on impacts due to accidental oiling. Limited impacts on individual endangered or threatened birds occurring the Atlantic OCS, with the exception of the Bermuda petrel (which is not considered particularly susceptible to this impact) are not expected to measurably affect the respective populations of the affected species.

CONCLUSION: Routine activities and accidents and non-OCS operations under the cumulative scenario are not expected to result in measurable changes to the population size, distribution, and behavior of the endangered and threatened bird populations occurring on the Atlantic OCS and adjoining coastal areas.

2) Nonendangered Species

The existing condition of the nonendangered and nonthreatened bird species are described in Sections III.D.2.b.2 and IV.D.1.a(5). Non-OCS impacts which affect nonendangered and nonthreatened birds are varied and their potential for impacts are dependent on the particular species under consideration. Non-OCS gas and oil impacts which are known to affect nonendangered and nonthreatened bird populations include degradation or loss of habitat, human encroachment, chemical pollution, hunting pressures (waterfowl), fisheries interactions, and persistent marine debris.

Routine impact factors include noise, vessel and aircraft traffic, offshore structures, artificial light, muds and cuttings discharges, and pipeline construction.

Special protections provide for the safeguarding of nonendangered and nonthreatened birds and any important or critical habitat on which these resources may depend. Should specific concerns be identified, the RD may require the lessee to undertake biological surveys or other appropriate actions in order to determine the extent of the affected resource and the degree of potential impacts to which it may be subject. These actions may result in the modification of proposed operations.

For a description of the potential accidents under the cumulative scenario, the reader is referred to the preceding discussion in this section on endangered and threatened birds.

Due to similarities between potential routine impact-producing factors and infrastructure described in Section IV.D.1.b(5), the potential impacts for this scenario are not expected to differ substantively.

Noise is not expected to be a measurable source of impacts to nonendangered and nonthreatened birds. Aircraft traffic will likely result in short-term startle reactions and avoidance behavior among some species. Likewise, geophysical surveys and vessel traffic may produce similar short-term and nonlethal impacts. No measurable changes in abundance, population size, distribution, or behavior of nonendangered and nonthreatened birds on the Atlantic OCS are expected.

The discharge of 2.3 Mbbl of muds and 0.9 Mbbl of cuttings is not expected to affect populations of nonendangered and nonthreatened birds occurring on the Atlantic OCS. These materials are essentially non-toxic, disperse rapidly, and have a negligible potential for measurable bioaccumulation in seabirds. Therefore, no nonendangered and nonthreatened bird populations occurring in offshore waters are expected to be measurably impacted by muds and cuttings discharges.

The 1,130 km of pipeline and 4 landfalls identified for this cumulative scenario are identical with the proposed infrastructure under the cumulative-case scenario. As in the high-case scenario (see Section IV.D.b(5)), no measurable impacts on nonendangered and nonthreatened bird populations are expected due to pipeline construction.

In addition to the assumed routine operational activities, nonendangered and nonthreatened bird populations are assumed to be exposed to accidental oil spills. In this cumulative scenario, the 23 operational spills (up to 50 bbl) do not differ significantly from the 21 operational discharges assumed for the 30-year base-case scenario (see Section IV.D.1.a(5)). Nor does the 1 small spill assumed here differ from the single small spill assumed under the base case. Although it is likely that some birds will be killed and others impacted sublethally, the expected level of impact on affected nonendangered and nonthreatened species is not considered likely to differ from the impact conclusions for these accidental discharges under the high case.

Oil kills birds by damaging the affected individuals' feathers which normally provide insulation and buoyancy. These two properties of feathers are particularly important to those species which spend considerable time in contact with the water, such as seaducks or other waterfowl. The numbers and species of birds which could be affected in any given location on the mid- and south Atlantic OCS vary seasonally due to changes in community structure brought about by migration. In addition, as described in Section IV.D.1.a(5), spilled oil is not likely to impact marine, coastal, shore, wading, or waterfowl species uniformly. Nor, even among these groups, is the susceptibility of species equal. It is possible that several thousand birds will be lethally affected as a consequence of the assumed 9 offshore, and 4 port spills. Depending on circumstances, it is possible that the number of birds affected by these assumed tanker spills could be much greater.

The majority of spills will occur offshore on the mid- and south Atlantic OCS. There are no spills assumed for the north Atlantic or the Straits of Florida.

As 8 spills 1,000 bbl or greater are assumed to occur offshore in the mid- Atlantic over a 30 year period, it is possible that at least 1, if not more, could occur at a time and place to impact thousands of birds. In connection with the remaining assumed spills, repeated impacts on some species (in particular those with low reproductive rates, limited reserve populations, sexual or age specific flocks, and other aspects of a population ecology which may make recovery from oiling impacts less rapid than among other birds), could conceivably result in impacts at the population level which may be measurable and significant for some species.

Unlike the 9 offshore spills, the 4 spills assumed for port waters are not considered likely to measurably impact populations of coastal, waterfowl, shore, or wading bird species. As discussed in Section IV.D.1.a(5), waterfowl are the most vulnerable group of birds to oiling impacts in coastal waters. Shorebirds and wader are not considered nearly as susceptible oiling due to habitat preferences and behavior. Developing and incubating young of all birds are vulnerable to oil transferred from the adult to the chicks. This type of contamination is expected to result in some level of reproductive failure assuming a port spill contacts shore areas or nearshore foraging and wetland habitats during the reproductive season. It is expected that bird mortality will be replaced by immigrants, non-breeding birds, and by the general fecundity these populations. Recovery of affected local subpopulations to pre-impact levels is expected within 2 to 4 years. Therefore, spill-site specific impacts from 4 port discharges over 30 years, even in the same location, would not necessarily result in measurable changes to any coastal, shorebird, or wading species' overall abundance, distribution, or behavior on the Atlantic OCS. However, the 13 spills 1,00 bbl or greater assumed for this cumulative scenario could be viewed, in light of additional non-OCS pressures on these populations, as a contributing factor toward a future condition of diminished coastal seabird, shorebird, and waterfowl abundance on the Atlantic OCS.

CONCLUSION: Routine activities and accidents associated with the cumulative scenario for the proposal are not expected to result in any measurable change in distribution, abundance, population size, or behavior among the nonendangered and nonthreatened bird species on the Atlantic OCS.

However, several non-OCS impacts which are expected to continue over the 30-yearlife of the proposed program, in concert with the assumed tanker accidents, could result in some measurable decline in the abundance of some species of nonendangered and nonthreatened marine and coastal birds on the Atlantic OCS.

(6) Impacts on Fish Resources

(a) Gulf of Mexico Region

1) Gulf Sturgeon

This cumulative analysis considers the effects of impact-producing factors related to the alteration and destruction of habitat; meteorological conditions; commercial fishing on the Gulf sturgeon; State oil and gas activity; crude oil imports by tanker; and the proposed action, prior, and future OCS sales. These impact-producing factors and their effects are discussed in detail in Section IV.A.

The Gulf sturgeon ranges in nearshore, inshore and freshwater from the Atchafalaya River in central Louisiana to the Suwannee River in the Florida panhandle. Gulf sturgeon are thought to spawn in rivers from the Pearl River area in western Mississippi to the Suwannee River in the Florida Panhandle. Gulf sturgeon are anadromous, spending a major portion of their lives in rivers or bays, and making winter marine migrations as they grow older. The population is severely depressed from historic numbers and has been extirpated from several of its historic spawning rivers.

An unknown but substantial amount of coastal construction is possible due to further urbanization, especially in the northeastern Gulf. Coastal development falls under the jurisdiction of individual states. However, it is expected that coastal urbanization will adversely affect Gulf sturgeon through loss of feeding and spawning habitat and increased point and non-point pollution. It is expected that these adverse effects will displace Gulf sturgeon resulting in a decline in populations resulting in a change in distribution and/or abundance of Gulf sturgeon in localized areas of the Gulf of Mexico, specifically from central Louisiana to northwestern Florida, not including the Suwannee River area. Should coastal urbanization cease, the affected populations would stabilize (not increase) within two generations.

Meteorological conditions of natural catastrophes including storms, floods, droughts, and hurricanes can result in substantial damage to Gulf sturgeon habitats. It is expected that meteorological factors will cause a decline in populations resulting in a change in distribution and/or abundance of Gulf sturgeon in localized areas of the Gulf of Mexico, specifically from central Louisiana to northwestern Florida, not including the Suwannee River area. Should natural catastrophes cease adversely affecting Gulf sturgeon, the affected populations would stabilize (not increase) within two generations.

Dredge and fill activities occur throughout the nearshore areas of the United States. They range in scope from propeller dredging by recreational boats to large-scale navigation dredging and fill for land reclamation. It is expected that dredge and fill activities will cause a decline in populations resulting in a change in distribution and/or abundance of Gulf sturgeon in localized areas of the Gulf of Mexico, specifically from central Louisiana to northwestern Florida, not including the Suwannee River area. Should dredge and fill activities cease adversely affecting Gulf sturgeon the populations will return to their former level within one to two generations.

Fishing techniques such as trawling, gill netting, or purse seining, when practiced non-selectively, may reduce the standing stocks of the desired target species as well as significantly impact species other than the target. It is estimated that for every 0.5 kg of shrimp harvested, 4 kg of bycatch that includes a number of Gulf sturgeon is discarded (Sport Fishing Institute, 1989a, b). It is expected that commercial fishing will cause a decline in Gulf sturgeon populations resulting in a change in distribution and/or abundance of Gulf sturgeon within the Gulf of Mexico. Should commercial fishing cease adversely affecting Gulf sturgeon, the affected populations would stabilize (not increase) within two to three generations.

A number of activities associated with State oil and gas operations could impact the Gulf sturgeon. These would include routine operational discharges and accidental spills; refining and processing activities; support vessel traffic; pipeline activities; coastal geophysical and platform removal activities using explosives; and transport and disposal of oilfield wastes. The effects on the Gulf sturgeon would be similar to those discussed in the base case.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)).

It is assumed that there will be contact between the Gulf sturgeon and spilled oil as a result of factors related to the proposed action plus those related to prior and future OCS sales, and crude oil imports by tanker. It is assumed that the extent and severity of effects on Gulf sturgeon from oil spills of any size will be limited and lessened due to some capability to actively avoid an oil spill, and to metabolize hydrocarbons and to excrete both metabolites and parent compounds from their gills and liver. In the event that oiling of Gulf sturgeon by oil spills (1,000 bbl or greater) should occur, it is expected that the effects would primarily be sublethal with fewer than five deaths. The effects of small oil spills on Gulf sturgeon are expected to be solely sublethal due to the inconsiderable area affected. In the event that oil spills of any size should reach critical habitats for feeding or spawning of Gulf sturgeon, sublethal effects are expected because oil spill contingency plans include special notice to minimize adverse effects during cleanup activities. The effect on Gulf sturgeon from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All deaths of Gulf sturgeon affected by spilled oil will be replaced through natural recruitment within two to three generations.

In summary, a number of activities such as oil spills, alteration and destruction of habitat, and meteorological conditions, may adversely affect Gulf sturgeon. It is expected that habitat loss from meteorological conditions of natural catastrophes, coastal urbanization, and dredge and fill activities will cause a decline in Gulf sturgeon populations resulting in a change in distribution and/or abundance of Gulf sturgeon in the Gulf of Mexico, specifically from central Louisiana to northwestern Florida, not including the Suwannee River area. It is expected that commercial fishing will cause a decline in Gulf sturgeon populations resulting in a change in distribution and/or abundance of Gulf sturgeon within the Gulf of Mexico. Accidental discharges of oil and produced products are expected to affect several thousand hectares of wetlands and hundreds of kilometers of coastline. The effect on Gulf sturgeon from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. In the event that oil spills of any size should reach critical habitats of Gulf sturgeon for feeding or spawning, sublethal effects lasting less than one generation are expected because oil spill contingency plans include special notice to minimize adverse effects during cleanup activities.

CONCLUSION: Under the cumulative scenario, a decline in Gulf sturgeon populations is expected resulting in a change in distribution and/or abundance in the Gulf of Mexico Region. All Gulf sturgeon affected by spilled oil will be replaced through natural recruitment within two to three generations. Commercial fishing activities are considered the most damaging to Gulf sturgeon populations within the Gulf of Mexico. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a(6)) to the cumulative impact is negligible because it is expected that from the proposed action the effect on Gulf sturgeon would be undetectable and recovery from any sublethal effects will require less than one year.

2) Other Fish Resources

This cumulative analysis considers the present status of fish resource populations, migratory habits, and the effects of impact-producing factors related to habitat loss; geographical and meteorological conditions; State oil and gas activity; tankering of crude oil imports; and the proposed action, prior and future OCS that may occur and adversely affect those populations. These impact-producing factors and their effects are discussed in detail in Section IV.A.

Approximately 46 percent of the southeastern United States wetlands and estuaries important to fish resources are located within the Gulf of Mexico (Mager and Ruebsamen, 1988). Consequently, both finfish and shellfish resources that are estuary-dependent species dominate the fisheries. The degradation of inshore water quality and loss of Gulf wetlands as nursery areas are considered serious threats to the commercial fishing industry (Angelovic, written comm., 1989; Christmas et al., 1988; USEPA, 1989a). Fish resource nursery areas in the Gulf of Mexico are believed to be in decline due to habitat loss from channelization, river control, subsidence of wetlands, urbanization and improper water management practices (Turner and Cahoon, 1987). It is assumed that habitat loss for Gulf of Mexico fish resources will continue. It is expected that habitat loss will cause a decline in populations or species resulting in a change in distribution and/or abundance of fish resources in the Gulf of Mexico. Should habitat loss cease, the affected populations or species would stabilize (not increase) within two to three generations.

Meteorological conditions of coastal storms and hurricanes may impact commercial fisheries by destroying oyster reefs, damaging gear and shore facilities, and changing physical characteristics of inshore and offshore ecosystems. High levels of oil and organic chemical contamination in the river runoff into the northern Gulf of Mexico cause sublethal effects directly on fish resources and indirectly through contamination throughout the food chain. It is expected that coastal storms and hurricanes and contamination by Mississippi River runoff will cause a decline in populations or species resulting in a change in distribution and/or abundance of fish resources within the Gulf of Mexico. Should these factors cease adversely affecting fish resources the populations or species will return to their former level within one to two generations.

A number of activities associated with State oil and gas operations could impact other fish resources. These would include routine operational discharges and accidental spills; refining and processing activities; support vessel traffic; pipeline activities; coastal geophysical and platform removal activities using explosives; and transport, storage, and disposal of oilfield wastes. The effects on other fish resources would be similar to those discussed in the base case and below.

In the past, produced waters discharged from State oil and gas activities have been substantial and have had adverse effects at many of the discharge sites. In 1986, 1,524,962 BPD of produced water were discharged from 682 separation facilities associated with the Louisiana State oil and gas industry (Boesch and Rabalais, 1989a, b). In this report, it was estimated that another 823,575 bbl of produced waters from Texas State oil and gas activities were discharged daily into Texas State waters. It is anticipated that elevated levels of salinity (50-150 ppt), dissolved and dispersed petroleum hydrocarbons (10-50 ppm), organic acids, radionuclides, and trace metals may result around discharge sites. Concentrations of the organic constituents will depend on the separation and treatment technologies employed. Substantial hydrocarbon contamination of fine-grained sediments may extend out from several hundred meters to over one kilometer from the point of discharge. Concentrations of aromatic hydrocarbons in sediments may exceed background levels by over an order of magnitude. In March 1991, the Louisiana State Legislature approved regulations banning the discharge, into State waters, of all oil and gas activity derived wastewaters (primarily produced waters). The State's effluent guideline standards have been revised such that there shall be no discharge of produced waters into State waters after January 1, 1995, unless the discharge(s) are authorized in an approved elimination schedule or is in effluent limitation compliance. Based on this legislation, it is difficult to project the extent of impact, if any, of these future discharges.

At sites continuing the practice of coastal discharge it is expected that these discharges will cause mortality or sublethal effects which result in a decline of both finfish and shellfish resources at sites in coastal Louisiana. Within a one kilometer radius of the discharge point, produced waters will decrease and may eliminate food sources for juvenile finfish and direct ingestion of, or exposure to contaminated sediments for several days would have a lethal/sublethal effect on shellfish depending on species, size and age. Oysters, located with one kilometer to inshore discharge sites, bioaccumulate hydrocarbons from produced waters (Boesch and Rabalais, 1989a, b). This accumulation could potentially render the oysters permanently unmarketable and will cause sublethal effects to all oyster life stages, within one kilometer of the discharge site during the time of contact. Further, the duration of adverse effects will occur and accumulate during the period of discharge and should discharge cease, recovery will require five to 10 years. However, the effect on Gulf of Mexico fish resources from the discharge of produced waters into inshore Louisiana is expected to be undetectable and any annual loss to Gulfwide fish resources will be replaced through natural recruitment from the next generation.

With regard to activities related to the proposal, fish resources may be adversely affected by the operational discharge of drilling muds offshore. It is assumed that about 268 exploration and development wells will be drilled annually as a result of the proposed action, prior, and future OCS sales. It is assumed that approximately 113.53 million bbl of drilling muds and 33.44 million bbl of drill cuttings will be discharged over the 45-year life of the proposed program (average approximately 7,000 bbl/day). Drilling muds contain materials toxic to marine fishes; however, this is only at concentrations four or five orders of magnitude higher than those found more than a few meters from the discharge point (NAS, 1983). Further dilution is extremely rapid in offshore waters to the extent that every substance measured in the water column is at background levels at a distance of 1,000 m of the discharge point (ECOMAR, Inc., 1980). It is assumed that offshore discharges of drilling muds will rapidly dilute to background levels. It is expected that the operational discharge of drilling muds offshore will not affect fish resources.

Of the some 15.7 billion bbl estimated to be produced from exploration and production activities associated with the proposed action, prior, and future OCS sales, it is estimated that about 12.56 billion barrels of produced waters will be discharged offshore. Produced waters that are discharged offshore are diluted, dispersed rapidly, and undetectable at a distance of 100 m from the discharge point and detectable effects are limited to within a few meters of the source (Harper, 1986; Middleditch, 1981). It is assumed that offshore discharges of produced waters will rapidly dilute to background levels. It is expected that the operational discharge of produced waters offshore will not affect fish resources.

It is assumed that about 3.14 billion bbl of produced waters will transported ashore for disposal in coastal Louisiana. This is based on the determination that 20 percent of the total amount of OCS-produced waters projected for this proposed action will be piped ashore. An unknown but expected substantial amount of produced waters will be discharge into coastal Louisiana from State oil and gas activities. Produced waters discharged into inshore and protected waters result in both lethal and sublethal effects on fish resources, such as menhaden, shrimp, blue crabs, and sciaenids that use that area contacted by produced waters as a nursery and/or spawning ground (Boesch and Rabalais, 1989a, b). The aerial extent of sediment contamination and potential adverse effects from produced water discharge within inshore protected waters extend from 50 m to 1 km from the discharge points (Boesch and Rabalais, 1989a, b). Based on the new regulations and discussions with OCS produced water site operators, it is assumed that these sites will either discontinue their operations, employ reinjection methods, modify existing operations and pipe the treated waters back offshore, or discharge the treated waters into the Mississippi River (at select sites). Therefore, the disposal of OCS-related produced waters onshore is not expected to impact fish resources in coastal and nearshore waters.

Lessees are required to remove all structures and underwater obstructions from their leases in the Federal OCS within one year of the lease's relinquishment or termination. It is estimated that 3,120 production platforms will be removed from the Gulf of Mexico as a result of the proposed action, prior, and future OCS sales. Peak year estimates are on the order of 160 removals, Gulfwide. It is assumed that structure removals will be uncommon events and estimated that lethal effects occur within 50 m and sublethal effects occur within 150 m of the removal site. It is expected that platform removals will cause a decline in populations or species resulting in a change in distribution and/or abundance of fish resources at 160 localized sites per year in the Gulf of Mexico. Should platform removals cease, the affected populations or species would stabilize (not increase) within one to two generations.

The sources of acoustical pulse used in seismic surveys are generated by airguns, waterguns, or high explosives (dynamite). High explosives can be lethal to fish at all life stages while airguns and waterguns have little effect on even the most sensitive fish eggs at distances of five meters from the discharge (Falk and Lawrence, 1973). In general, the acoustical pulse from even high explosives have relatively little effect on marine invertebrates, presumably due to their lack of a swim bladder. Available scientific information concerning the effects of acoustic airgun/watergun sources on fish eggs and larvae indicate that finfish resources are little disturbed by seismic surveys (Wingert, 1988). Greater than 90 percent of seismic surveys in the Gulf of Mexico use air guns to generate pulses. It is assumed that only air guns or water guns will be used in seismic surveys as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. It is expected that seismic surveys will not affect fish resources.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)).

It is assumed that there will be contact between fish resources and spilled oil as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. Both lethal and sublethal effects on fish resources are expected. The extent and severity of effects on adult fish resources will be limited and lessened due to some capability to actively avoid an oil spill, and to metabolize hydrocarbons and to excrete both metabolites and parent compounds from their gills and liver. Greater than 80 percent of the fish resources in the Gulf of Mexico are estuary-dependent species (Mager and Ruebsamen, 1989) and the effects from an oil spill contacting a Gulf estuary would adversely affect fish resources for such species as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters that use that area as a nursery and/or spawning ground. It is expected that oils spills will cause a decline in populations or species resulting in a change in distribution and/or abundance of fish resources within the Gulf of Mexico. All fish resources affected by spilled oil will be replaced through natural recruitment within one to two generations.

It is estimated that a total of about 138 subsurface blowouts will occur from the proposed action, prior, and future OCS sales and that they will not occur in the same year. This is based on an estimate of 7 blowouts for every 1,000 wells. It is assumed that subsurface blowouts are uncommon events and estimated that blowouts cause both lethal and sublethal effects on fish resources within 50 m of the blowout site. The effect on fish resources from subsurface blowouts is expected to undetectable and any loss to Gulfwide fish resources will be replaced through natural selection from the next generation.

In summary, a number of activities such as overfishing, operational discharges, platform removals, seismic surveys, oil spills, subsurface blowouts, loss of wetland nursery habitat, and meteorological conditions, may adversely affect fish resources in the Gulf of Mexico. It is expected that overfishing of targeted fish resources and trawl fishery bycatch will cause a decline in populations and or species resulting in a change in distribution and/or abundance of fish resources in the Gulf of Mexico. It is expected that coastal storms and hurricanes and contamination by Mississippi River runoff will cause a decline in populations or species resulting in a change in distribution and/or abundance of fish resources within the Gulf of Mexico. It is expected that the operational discharge of produced waters offshore will not affect fish resources. It is expected that inshore discharge of produced waters will cause mortality or sublethal effects which result in a decline of both finfish and shellfish resources at sites in coastal Texas and Louisiana. However, the effect on Gulf of Mexico fish resources from the discharge of produced waters inshore is expected to be undetectable. It is expected that platform removals will cause a decline in populations or species resulting in a change in distribution and/or abundance of fish resources at 160 localized sites per year in the Gulf of Mexico. It is expected that seismic surveys will not affect fish resources. Accidental discharges of oil and produced products are expected to affect several thousand hectares of wetlands and hundreds of kilometers of coastline. It is expected that oils spills will cause a decline in populations or species resulting in a change in distribution and/or abundance of fish resources within the Gulf of Mexico. The effect on Gulf of Mexico fish resources from uncommon subsurface blowouts is expected to undetectable.

CONCLUSION: Under the cumulative scenario, a decline in fish resource populations and/or species is expected resulting in a change in distribution and/or abundance in the Gulf of Mexico Region. All fish resources affected by spilled oil will be replaced through natural recruitment within two to three generations. Overfishing and loss of nursery habitat are considered the most damaging to Gulf of Mexico fish resources. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a(6)) to the cumulative impact is negligible because from the proposed action the effect on fish resources is expected to be undetectable to estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters, to pelagic species such as mackerels, cobia, bluefish, amberjack, and dolphin fish, and to reef fish species such as grouper, snapper, gag, scamp, and seabass. A loss of fish resources will be replaced through natural recruitment from the next generation.

(b) Alaska Region

1) Pacific Salmon (Alaska Population)

The impact-producing agents (IPA's) of the cumulative case are the same as presented in the base-case analysis with the following additions. Proposed State of Alaska upland and offshore oil and gas lease sales and oil and gas lease sales or Native-owned uplands could have a cumulative effect on salmon populations. An increased number of oil spills (of 1,000 bbl or greater) from the proposed action and increased numbers of drilling locations would further increase and distribute drilling discharges. Finally, both offshore and onshore construction would increase in number and distribution. Other listed cumulative activities would have virtual no effect on Pacific salmon.

Drilling discharges would increase cumulatively from State of Alaska offshore oil and gas leasing and could threaten fisheries streams. These discharges are also increased on state-owned uplands and on Alaska Native Corporation lands. For marine waters, studies have shown that drilling discharges affect only limited radii from the benthic discharge point. Section IV.D.1.a(1) (Water Quality) of this document assesses the dispersals of these discharges into the marine environment. It is unlikely that migratory Pacific salmon in pelagic waters would be affected by these discharges to the benthos because of the limited area of discharge and the wide distribution of the salmon.

Drilling discharges on uplands are confined and handled in accordance with State of Alaska and Environmental Protection Agency regulations and routinely should have no effect on salmon.

Offshore construction in State of Alaska waters could cumulatively affect salmon that migrate in Upper Cook Inlet, the only State oil and gas leasing area where salmon are found. During placement of drilling platforms and pipeline laying in this area, migratory salmon might be delayed or diverted (but only during the time of construction in these already turbid waters). This delay would be measurable in no more than hours, in diversions probably no more than within a few hundred to 1,000 ft. Based on the experience with oil and gas exploration and development in Upper Cook Inlet dating back to the early 1960's, these activities have had no adverse effect on salmon.

For the cumulative case, the projected number of oil spills also increases; those spills with potential to affect salmon are mostly limited to State oil and gas leasing in Cook Inlet because the State waters of the Beaufort Sea are devoid of salmon. To affect salmon, these oil spills would have to occur during their migrations in Cook Inlet, about mid-May through mid-September, or 4 months annually. During this time in the relatively restricted waters of Cook Inlet, an oil spill could have an effect on salmon migrations; although given the aversive reactions of salmon to oil spills and their relatively rapid migrations and distribution, in comparison with the limited movement and distribution of an oil spill, probably less than 1 percent of the total population would be affected.

In the cumulative case, Pacific salmon would be exposed to the effects of oil and gas operations in Cook Inlet and not to other operations elsewhere. To date, current oil and gas operations in this area have not had large-scale adverse effects on the area's salmon populations.

CONCLUSION: Under the cumulative scenario, there would be no measurable effect on salmon over the 24- to 34-year period of the proposed action.

2) Walleye Pollock

Walleye pollock and other species of the groundfish complex of the eastern Bering Sea and Gulf of Alaska would not be cumulatively affected beyond the proposed action levels of oil and gas exploration/development which found no appreciable adverse effects on this group. The cumulative activities under discussion do not encroach on areas where groundfish occur.

Drilling discharges (muds, cuttings, formation waters, and various mud additives) could impact groundfish habitat and have a toxic effect to this group. Offshore construction (platforms and pipelines) might temporarily displace groundfish, although the former might afford refuge in some benthic environments. Drilling discharges in the Alaska Region usually affect only the benthos.

Any effect of drilling discharges on walleye pollock and other groundfish would be limited to any few fish in close proximity to the discharge point, measured in tens of meters. Because of the limited areal extent of discharge effects and the level of activity in the Alaska Region, the impact of drilling discharges on walleye pollock would not be appreciable.

Offshore construction, platforms, and pipelines could displace walleye pollock during construction. This would be a temporary effect without a long-term impact. There is some evidence that offshore structures are attractive to some fishes, affording refuge for the fish and substrate for their food organisms.

Oil spills have the potential to affect the groundfish of the Alaska Region. Adult groundfish, however, are largely demersal. Here, these finfishes would only be subject to the insoluble oil and water-soluble fractions of oil that reach these habitats.

Adult walleye pollock congregate annually during the spring to spawn in pelagic waters. Spawning areas have been identified in the Shelikof Strait near Kodiak and along the shelf break immediately north of the Alaska Peninsula near Unimak Pass. The eggs and early larvae of the walleye pollock are found in pelagic waters during early development, gradually descending to the benthos. During this time, the eggs or larvae could be contacted by an oil spill. Based on past events and computer-simulated studies, the areal extent of all but the largest oil spills is most limited, and weathering and evaporation over a short time rapidly reduces the oil to below toxic levels for groundfish.

Alaska Region walleye pollock and other groundfish might be contacted by insoluble oil fractions that sink to the ocean bottom. These “tarballs” would be distributed over large areas of the ocean by waves and currents to thousands of square miles. Discontinuous, the oil would be much dispersed over the benthos and not likely to affect demersal groundfishes.

CONCLUSION: The cumulative level of OCS and Non-OCS oil and gas exploration/development is not likely to have a measurable effect on groundfish populations.

3) Arctic Cisco

The arctic cisco might be affected by cumulative activities beyond those assessed by the base- and high-case levels of oil and gas exploration and development. These cumulative effects would be (1) increased volume/weight of drilling discharges from offshore leasing in State waters in the Beaufort Sea, (2) increased construction (drilling pads and causeways) required for oil and gas exploration and development in the State waters of the Beaufort Sea, and (3) increased number/volume of oil spills from State of Alaska offshore leasing in State waters. The arctic cisco migrates in the Beaufort Sea and is limited to this area.

While drilling discharges increase, their effects on pelagic fish such as the cisco are expected to be innocuous because the discharge points are quite some distance and depth from the migratory passage of the pelagic cisco. Additional offshore cumulative-case construction, principally causeways, could further deter and delay migrations of arctic cisco with some adverse effect. Properly breached, however, these delays and diversions may be alleviated to a large degree without the subsequent adverse effect on this fish species. See the cumulative-case analysis in USDOI, MMS (1990c).

The construction of causeways in the nearshore Beaufort Sea is an issue of concern for anadromous fishes, including the arctic cisco, since causeways without adequate breaches have the potential for affecting fish populations by: (1) physically blocking or impeding migrations, and/or (2) altering the physical environment and affecting migrations, feeding, and rearing. At the present time, two major causeways, the West Dock and Endicott causeways have been built in the Prudhoe Bay–Sagavanirktok River area. The West Dock causeway, with one relatively small 50-foot breach, has significantly altered the physical oceanographic regime nearshore, which is extensively used by anadromous fishes (Craig and Griffiths, 1981; Mungall et al., 1978; Cannon and Hachmeister, 1987). The extent of alteration of the physical environment near the Endicott causeway constructed with one breach of 200 feet and one of 500 feet is currently being reviewed. Alteration of the physical regime could be important to arctic cisco and other anadromous species, since these fishes have varying tolerances to temperature and salinity ranges. Deflection of, or the creation of discontinuities in the band of relatively warm, brackish water that occurs in the open-water season along the Alaskan Beaufort Sea coast could affect migrations, the extent of feeding habitat, overwintering success, and fecundity of arctic ciscoes and other anadromous species. The extensive migrations that arctic cisco are believed to undergo may make them more susceptible than other fish to effects from causeway construction.

Although the linkage between habitat alteration effects induced by causeways and effects on fish populations has not been adequately made, the potential for these population-level effects certainly exists. More specific effects, such as the impedance of movements of arctic cisco near the West Dock causeway have been documented (Moulton, Field, and Brotherton, 1986). Since it is quite possible that other causeways could be built in the Alaskan Beaufort Sea, the effects so far observed may become magnified, and other effects may appear if additional causeways are built. Causeways are persistent features; thus, the effects of causeways without adequate breaches are likely to persist for more than one generation of fishes. The magnitude of effect will be dependent on the design and construction of the causeway. Solid filled or inadequately breached causeways could result in persistent changes in fish populations and distributions. Causeways with adequate breaching are likely to have little effect on arctic cisco.

It is assumed for the cumulative-case scenario that two or more oil spills will occur in the Beaufort Sea. Arctic cisco are vulnerable to effects from oil spills because they are believed to make extensive migrations from and to what is believed to be their natal river, the Mackenzie. Various age classes could be vulnerable to spilled oil, but the variation in timing of their movements suggests that severe effects on all age classes are not likely to occur from a single spill. During the year in which they spawn, adults may migrate eastward from as far away as the Colville to the Mackenzie, beginning their movements early in the open-water season. The departure of these spawning-year fish from coastal areas leaves the nearshore habitat occupied by juveniles and mature non-spawners throughout the summer (Bond, 1982). Most studies along the Beaufort Sea coast have found few mature arctic cisco during the summer (Bond, 1982; Griffiths, den Beste, and Craig, 1977; Galbraith and Hunter, 1975; Jones and den Beste, 1977; and Lawrence, Lacho, and Davies, 1984). Young-of-the-year arctic cisco moving westward from the Mackenzie to the Colville appear in western Canadian waters about mid-July and start reaching the Colville in late August. In 1985, catches of 0-age arctic cisco increased in number until sampling ceased September 11 (Fawcett, Moulton, and Carpenter, 1986). Thus, an oil spill contacting the nearshore zone may affect an assemblage of variously aged arctic ciscoes but is unlikely to decimate the majority of both those migrating to spawn and young-of-the-year. If either one of these groups were greatly affected, then possibly a year-class could be reduced significantly. The spatial and temporal spread in movements of a single year-class (i.e., they arrive at a location over a period of time) reduces the probability of large effects to an age class.

CONCLUSION: Based on the cumulative assumptions for the Beaufort Sea, the overall cumulative impacts have no measurable effect on arctic cisco that migrate to and from the MacKenzie or those that stay in the nearshore habitat.

4) Other Fish Resources

FINFISH: Drilling discharges and offshore construction (platforms and pipelines) have the potential to affect other finfish. Drilling discharges contain materials toxic to fish and, in addition, disrupt and disturb benthic finfish habitats. For the Alaska Region, a total of 14 platforms are planned for the proposed action. As discussed and assessed previously, studies indicate that any adverse effects on salmon, walleye pollock, arctic cisco, and Pacific herring from these discharges are minimal, because the area of habitat affected is small and any toxic compounds are rapidly dissipated to where concentrations injurious to finfish usually are not found beyond a radius of more than 100 m from the discharge point. Benthic disturbance/disruption from insoluble components of these discharges also are limited in area, usually to much less than 100 m in radius from the discharge point. These discharges also may be intermittent, further lowering any adverse effects. Pipeline construction also might affect other finfish during the time of installation, principally from turbidity and disturbance/displacement. These effects are temporary, measured perhaps in hours during and immediately following pipe laying. These effects also are confined to the small area adjacent to the construction zone. Only a few finfish would be affected by the construction for a limited period of time. Impacts would be minimal.

Oil spills would be the major agents with the potential to adversely affect the other finfishes of the Alaska Region. As assessed for Pacific salmon, walleye pollock, arctic cisco, and Pacific herring, these oil spills would have little effect on finfish, because the total number, volume, and probably intermittent frequency of spills are all low in number. Based on the previous analysis, there would be little or no adverse effects on other finfish from large oil spills.

CONCLUSION: The overall cumulative level of OCS and non-OCS oil and gas exploration/development activity have no measurable effect on other finfishes of the Alaska Region.

SHELLFISH: At this time, the shellfish populations of the Alaska Region, as expected, vary in number by species and area (e.g., red king crab populations off Kodiak Island are too reduced to support commercial fishing, while numbers in the Bering Sea have increased to where commercial harvest is possible). Shrimp in the Alaska Region are reduced and now support only limited area and harvest-quota fisheries.

The cumulative case analyzes the following increments to the base case analyses: (1) additional State of Alaska and Native corporation oil and gas offshore and onshore leasing, (2) offshore and onshore mining, and (3) increased commercial and recreational fishing activity.

Past State of Alaska offshore oil and gas leasing has not affected Alaska Region shellfish populations. For the cumulative case, projected State sales are limited to Upper Cook Inlet and the Beaufort Sea. Shellfish are limited in numbers in Upper Cook Inlet, and there is no commercial fishing there. Beaufort Sea shellfish are small in size and numbers also are relatively few and have no commercial value. Proposed leasing on Native corporation uplands would have no effect on marine shellfish; likewise, onshore mining would have no effect. Any discharges from onshore mining operations must meet State and Federal water-quality criteria, which prohibit discharge of materials toxic to shellfish and other marine biota.

The sale of offshore leases near Nome, Alaska, would disrupt shellfish habitat with gold-dredging and have an effect on water quality. This is an example of where USEPA-State regulation and Federal monitoring will be employed to protect environmental resources.

Offshore construction in the Beaufort Sea, required for State oil and gas leasing and subsequent exploration and development, would affect only a small number of the few shellfish found in this area. Pipeline construction causes temporary disturbance in very small areas; and causeway construction, while removing shellfish habitat, does not remove any large percentage of benthic shellfish habitat.

Cumulative effects on shellfish from increased numbers and volumes of oil spills (Table IV.D.1.c-4) would, if they occurred during the inopportune short seasonal periods when the early lifestages of some shellfish (e.g., crab larvae) are in near-surface waters, have the increased potential to adversely affect these organisms. This cumulative increase, however, would not yet affect any large segment of these populations for the ratio of oiled-water area to shellfish-habitat area remains small, i.e., tens of units of oiled area as compared with thousands of units of shellfish habitat. Less than 1 percent of a given shellfish population in the Alaska Region would be proximate to an oil spill.

CONCLUSION: The cumulative case would have no measurable adverse effect on shellfish of the Alaska Region because the incremental discharges, constructions, and oil spills do not affect any large habitat areas for these organisms and/or do not have potential to occur where these groups are present.

(c) Pacific Region

1) Pacific Salmon (Pacific Population)

According to PFMC (1989) the status of major chinook, coho and pink salmon stocks from the rivers within the Pacific Region suggests that at least some populations or runs have increased in abundance over the past several years largely because of stringent management efforts. Although the greatest fishing pressure on salmon stocks is expected to occur in the Exclusive Economic Zone (EEZ) which is regulated by the PFMC offshore the Pacific Region, the survival of populations in spawning streams may be of equal or greater importance to the future of salmon stocks. Although a major goal of PFMC management efforts is to avoid overfishing and achieve spawning escapement goals, it is likely that some degree of overfishing will occur several times over the next 35 years because of the difficulty in assessing the abundance of spawning runs and then allocating the available fish among competing fisheries and escapement. Reductions in the abundance of specific salmon stocks are expected to result from this overfishing, but the impacts are expected to generally last from 1-5 years at most because of ongoing PFMC management efforts.

Factors that may produce cumulative effects on Pacific salmon populations in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to fish resources in U.S. waters include natural population abundances, commercial and recreational fishing operations, increases in agricultural runoff discharges, stream modification such as hydroelectric power projects, and Alaskan and foreign-import tankering.

Because the abundance of salmon runs and populations are partly related to the productive capacity of spawning and rearing habitats, habitat changes over the next 35 years are expected to influence the abundance of salmon populations. Habitat availability for many rivers in the Pacific Region, with or without rehabilitation efforts is expected to remain relatively unchanged over the next 10-20 years, except for marginal improvements in rivers supporting some stocks. Since restoration efforts are currently underway to restore stocks in some river systems within the Region, improvements in habitat and abundance can be expected for some stocks over the next 35 years. Long-term trends in the availability of habitat for salmon is expected to vary between stocks, depending in large part on whether rehabilitation or restoration efforts are conducted to improve habitat availability and reduce other existing impacts on the stock.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in Section IV.D.1.c. Most salmon spawning streams are removed from large metropolitan areas and would thus be more subject to agricultural pollution. However, as human populations of the Pacific Region continue to increase (Section IV.D.1.a(10), municipal and industrial wastewater discharges in streams and nearshore waters will increase. Ultimately, these increases would decrease salmon populations, decrease PFMC's ability to manage fishing pressure probably causing a further decrease in salmon populations in the next 35 years.

Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms are expected to occur at some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time. It is also assumed that one pipeline from an existing lease will be constructed to a shoreline landfall in the northern Santa Maria Basin.

Offshore construction, placement of 17 added platforms, and 120 miles of pipeline installation together with those already in existence would have only temporary impact on Pacific salmon due to increased turbidity during some construction operations. These impacts would last the several weeks required to complete the drilling or pipeline laying operation and would affect individual fish. Salmon populations will be unaffected at the local and regional level. Although the platforms and pipelines would remain for approximately 30 years, manmade structures are not expected to cause any detectable decreases in salmon populations since the number of structures anticipated and the area subject to possible disturbance from platform installation remains low relative to the large areas of similar depth and other environmental conditions available. Further, these structures are completely removed from salmon spawning areas, although pipelines could have greater adverse impact if located near or across salmon spawning streams. However, due to the high concern for the ecological balance of estuaries in southern California, it is assumed pipelines will not be located at these locations.

Migrating salmon are expected to be widely dispersed, and only a few fish are likely to come in contact with effluents and discharges from the added wells, since they are often discharged at depths below where migrating salmon would be contacted, discharged intermittently, and are diluted rapidly. The drilling discharges may cause short (minutes to hours) changes in the distribution of salmon in the immediate vicinity of the discharge point if fish avoid the discharge plume. Plume avoidance is not expected to cause any discernible impacts that would reduce the abundance of salmon populations.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on Pacific salmon populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

Impacts on salmon populations from oil spills have been discussed in Section IV.D.1.a(6). Due to the small salmon stocks in southern California, the spills have a low probability of contacting salmon populations, particularly during the most sensitive period. The life-history stages of Pacific salmon stocks most sensitive and vulnerable to oil exposure are outmigrating smolts, nearshore feeding juveniles, and adults that are beginning to ascend their home rivers to spawn. In two of three of these sensitive phases, oil must enter the mouth of a river estuary to cause an impact. Since river estuaries in southern California are rare, generally have narrow openings and are frequently closed off from the ocean for part of the year, it is unlikely the spill would enter and cause impacts. The assumption, therefore, is that oil will contact salmon in southern California while in the ocean.

Since salmon are migratory with limited time in a given ocean area, the probability of being contacted by the oil spill for an extended period of time anywhere in the Pacific Region is very low. A spill of 1,000 bbl or more, either offshore or coastal, would contact only a small portion of the pelagic salmon habitat. Salmon may be able to detect some hydrocarbons in the water and divert from these contaminated areas. Contact with the oil spill is expected to result in very low lethal or sublethal effects that would not be discernible from natural variations of salmon typical of the area.

Oil spills occurring in northern California, Oregon or Washington would be expected to enter a spawning stream causing a local impact amounting to mortality of hundreds of adult spawners or fry (incubating eggs would presumably be too far upstream to be reached by the spill). The impact would be primarily limited to the year class involved in the spill. Spawning the following year would be normal within normal yearly variations in a small rapid stream with a rapid flushing rate or within approximately 50 to 80 percent of normal in a larger slower flowing stream having a slower flushing rate. Oil would not remain or get hung up on objects in a stream with a rapid flushing rate since it would be washed back out to sea. The affected year class returning two to four years later (depending on species) should produce for seaward outmigration near or at normal levels since survival rates have a greater chance of being higher due to lessor crowding and competition allowed by fewer spawning adults. Because of the numerous spawning streams present in the Pacific northwest area, the regional impact caused by an impact in one stream would not be discernible from natural variations of populations within the area.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). In the Alaska Region, it is assumed that as many as 1,938 oil spills of 1-50 bbl and 79 spills of 50-999 bbl will occur over the life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above.

Considering the wide distribution of the comparatively small populations of salmon in the area and the extremely localized, short-term effects of the very small spills that have typically occurred in the region, the impacts to salmon populations would not be discernible, if they occur at all.

In summary, restoration of streams, hatchery releases and other PFMC fishing management practices may maintain the present salmon populations within many streams within the Pacific Region. However, most salmon spawning streams are removed from large metropolitan areas and industrial pollution apparently is not a factor at most locations of the present populations. However, as human populations of the Pacific Region continue to increase, municipal and industrial wastewater discharge in streams and nearshore waters will likewise increase. These increases will further decrease salmon populations, eventually decrease the Pacific Region's states ability to manage fishing pressure probably causing further overall decreases in salmon populations in the next 35 years.

Impacts to Pacific salmon populations within southern California from routine OCS activities associated with the proposed action would be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. Oil spills are expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon. Tanker oil spills entering a spawning stream in Washington would cause mortalities to hundreds of salmon (possibly 10 to 20%) in the stream affecting the impacted year class for two to four years. Regional impacts would be less, since not very stream within the various subregions within the Pacific Region would be affected and the relative number of the affected population would be lessened these impacts would not be discernible from natural variation.

CONCLUSION: Pacific salmon populations in the Pacific Region will fluctuate with high reproductive survival in some areas during some years with inconsistent poor survival at other locations. Ultimately, the population is expected to decrease due to increased human population, stream pollution, stream modification, and fishing pressure. Cumulative impacts to Pacific salmon populations within southern California from normal OCS activities will be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. Impacts from spills greater than or equal to 1,000 bbl are expected to result in low lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon. Oil spills entering a spawning stream in Washington, Oregon and northern California could cause mortalities to hundreds of salmons in the stream affecting the impacted year class for two to four years.

However, regional impacts would not be discernible from natural variations of populations within the area.

2) Steelhead Trout

The abundance of steelhead trout in the Pacific Region has declined since the 1950's due to increased sportfishing pressure and damage to freshwater and estuarine fish habitat as a result of dam construction, water diversion, other types of construction, and generally improper land-management practices (Barnhart, 1986, Pauley et al., 1986). Restoration attempts have been made using habitat enhancement and hatcheries. However, in some rivers steelhead production and a fishery would be nonexistent without hatchery-produced stocks. Steelhead populations in southern California are not abundant and are primarily limited to San Luis Obispo County. Reproducing populations may be even rarer in Alaska (see Section III.B.3).

Factors that may produce cumulative effects on steelhead trout populations in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to fish resources in U.S. waters include natural fluctuations in environmental conditions and of population abundances, recreational and tribal Indian fishing activities, loss and/or degradation of freshwater spawning and nursery habitat resulting from onshore activities such as, agricultural runoff, hydroelectric power projects, water diversions for agriculture and development, timber and construction activities resulting from increased human population, and Alaskan and foreign-import tankering.

Sport and tribal Indian fishing for steelhead produced from rivers in the Pacific region are expected to continue over the next 35 years primarily in the freshwater streams and rivers supporting individual stocks. Additional fishing effort is expected to occur in marine waters offshore California, Oregon, and Washington, and possibly offshore southeast Alaska and in the Gulf of Alaska as a result of foreign intercept. The most intense fishing pressure on steelhead stocks is expected to occur in the freshwater streams and rivers supporting steelhead production. In large part, the impact of sport and tribal Indian fishing pressure on the abundance of steelhead stocks will be based on the accuracy of pre-season stock abundance estimates made by the respective anadromous fish resource management agencies of the Pacific Region States and on the effectiveness of their management measures designed to control fishing pressure and harvest levels so that spawning escapement goals can be achieved and stock sizes maintained or increased.

Although a major goal of State agencies responsible for anadromous fish resource management is to avoid overfishing and achieve spawning escapement goals, it is very likely that some degree of overfishing will occur at least several times over the next 35 years because of the difficulty in accurately assessing the abundance of spawning runs, and then allocating the available fish among competing sport and tribal Indian fisheries and escapement. As with the steelhead trout, however, those stocks that continue to be impacted by existing activities over the next 35 years, and are not rebuilt or enhanced through restoration or rehabilitation efforts, may be particularly susceptible to cumulative impacts from other non-oil or oil-related activities.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in Section IV.A. Most steelhead spawning streams are removed from large metropolitan areas and would thus be more subject to agricultural pollution. However, as human populations of the Pacific Region continue to increase (Section IV.D.1.a(10), municipal and industrial wastewater discharges in streams and nearshore waters will likewise increase. Ultimately, these increases will further decrease steelhead populations, decrease the Pacific Region's States ability to ability to manage fishing pressure probably causing further overall decreases in steelhead populations in the next 35 years. Certain well managed streams, as suggested above, will continue at approximately present levels.

Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms are expected to occur at some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time. It is also assumed that one pipeline from an existing lease will be constructed to a shoreline landfall in the northern Santa Maria Basin.

Offshore construction, placement of 17 added platforms, and 120 miles of pipeline installation together with those already in existence would have only temporary impact on steelhead trout due to increased turbidity during some construction operations. These impacts would last the several weeks required to complete the drilling or pipeline laying operation and would affect individual fish. Steelhead populations will be unaffected at the local and regional level. Although the platforms and pipelines would remain for approximately 30 years, manmade structures are not expected to cause any detectable decreases in steelhead populations since the number of structures anticipated and the area subject to possible disturbance from platform installation remains low relative to the large areas of similar depth and other environmental conditions available. Further, these structures are completely removed from steelhead spawning areas, although pipelines could have greater adverse impact if located near or across steelhead spawning streams. However, due to the high concern for the ecological balance of estuaries in southern California, it is assumed pipelines will not be located at these locations.

The seasonal abundance of migratory steelhead in southern California is relatively low compared to other areas in the Pacific Region, but some migratory steelhead are expected to occur seasonally in southern California areas where drilling muds and cuttings from the increased wells will be discharged. Migrating steelhead are expected to be widely dispersed, and only a few fish are likely to come in contact with these materials, since they are discharged intermittently and are diluted rapidly. The drilling discharges may cause short (minutes to hours) changes in the distribution of steelhead in the immediate vicinity of the discharge point if fish avoid the discharge plume. Plume avoidance is not expected to cause any discernible impacts that would reduce the abundance of steelhead populations.

In the Alaska Region, there currently are no oil and gas activities in Federal OCS waters, although producing offshore leases do exist in State waters in the Cook Inlet and Beaufort Sea. The cumulative-case scenario for the Alaska Region assumes the construction of 21 platforms in OCS waters over the 40-year life of the proposed action. The number of platform removals expected during this period has not been estimated. Eighteen of these platforms are expected to be located in the Arctic and Bering Sea Subregions. No disruption of steelhead trout populations are expected from normal operations, in the Alaska Region, largely because of the extremely small steelhead populations in the area together with the reasons mentioned above for the California populations.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on steelhead trout populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under (Section IV.D.c(3)), Pacific Marine Mammals, Threatened and Endangered Cetaceans . That description includes assumptions regarding oil spill occurrence, source, and size.

Impacts on steelhead populations from oil spills have been discussed in Section IV.D.1.a(6). The life-history stages of steelhead stocks most sensitive and vulnerable to oil exposure are outmigrating smolts, nearshore feeding juveniles, and adults that are beginning to ascend their home rivers to spawn. Since river estuaries in southern California are rare, generally have narrow openings and are frequently closed off from the ocean for part of the year, most of the contacts with steelhead populations from oil spills over the next 35 years will occur in offshore oceanic areas. Although it remains unlikely an oil spill will enter a steelhead spawning stream, the large increase in the number of spills would eliminate the assumption of the base case (Section IV.D.1.a(6)) that such an event will not occur. The impacts to southern California steelhead populations from the large oil spill are generally expected to be localized due to the relatively few and widely separated steelhead streams in the planning area. Steelhead streams in southern California are restricted to San Luis Obispo County.

Since steelhead are migratory with limited time in a given ocean area, the probability of being contacted by the oil spill for an extended period of time is very low. A spill of 1,000 bbl or more would contact only a small portion of the pelagic steelhead habitat. Contact with the oil spill is expected to result in very low lethal or sublethal effects that would not be discernible from natural variations of steelhead populations typical of the area.

Stocks most affected by an oil spill are those in areas where steelhead producing rivers are located. These areas include Washington, Oregon, and northern and central California, but not southern California or the Gulf of Alaska. Oil spills that occur in the Gulf of Alaska or southern California are not expected to reduce steelhead stocks originating in Washington, Oregon, or California, since the life-history stages of these stocks that are most sensitive to oil spills typically do not occur in these areas.

The tanker oil spills contacting the entrance of a steelhead stream in Washington, Oregon, or California from San Luis Obispo County northward, would result in a moderate reduction of 10 to 20 percent of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Since steelhead produced in any year generally spend from 2-4 years at sea maturing before returning to spawn, the greatest decline in abundance of spawning runs or populations affected by an oil spill is expected to be spread over a period of 2-4 years following the spill. Regional impacts would be less, since not every stream would be affected and would not be discernible from natural variations of steelhead trout populations within the area.

Although steelhead trout range into the Alaska region as far as the Bering Sea and Bristol Bay, they are very uncommon north of southern British Columbia, Canada. In any region of Alaska, they are extremely rare, but, because of their large populations elsewhere on the Pacific coast, they are not threatened or endangered, forming a minor, portion of the pelagic community. Impacts from the Alaskan oil spills, therefore would not be distinguishable from natural population fluctuations, if impacts were to occur at all.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). In the Alaska Region, based on historic small spill data, it is assumed that numerous small spills will occur over the life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above. The impacts to steelhead populations would not be discernible, if they occur at all.

In summary, despite attempts at regulation of stream fishing, sports or trial overfishing should continue to decrease steelhead populations. Most steelhead spawning streams are removed from large metropolitan areas and industrial pollution apparently is not a factor at most locations of the present populations. However, as human populations of the Pacific Region continue to increase, municipal and industrial wastewater discharge in streams and nearshore waters will likewise increase. These increases will further decrease salmon populations, eventually decrease the Pacific Region's states ability to manage fishing pressure probably causing further overall decreases in salmon populations in the next 35 years.

Impacts to steelhead populations within southern California from routine OCS activities associated with the proposed action would be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. Oil spills are expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon. Tanker oil spills entering a spawning stream in Washington would cause mortalities to hundreds of salmon (possibly 10 to 20 percent) in the stream affecting the impacted year class for two to four years. Regional impacts would be less, since not very stream within the various subregions within the Pacific Region would be affected and the relative number of the affected population would be lessened these impacts would not be discernible from natural variation of steelhead trout populations within the affected area.

CONCLUSION: Steelhead trout populations in the Pacific Region are expected to continue to decrease due to recreational and tribal Indian fishing pressure, stream modifications, timber and agricultural projects, continual increases in human populations, and increased pollution of steelhead spawning streams. Impacts to steelhead trout populations within southern California and Alaska from routine activities will involve changes in the distribution of some migrating populations for a period of minutes to hours with no discernable change of population levels. Impacts from large spills (greater than or equal to 1,000 bbl) are expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore steelhead trout. The tanker oil spill contacting the entrance of a steelhead spawning stream in Washington, Oregon, California (as far south as San Luis Obispo County) or Alaska, could result in a reduction of 10-20 percent of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regionally, not every stream would be affected and the relative number of the affected population would be reduced , but would not be discernible from natural variations of steelhead trout populations within the area.

3) Pacific Whiting

Factors that may produce cumulative effects on Pacific whiting populations in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to fish resources in U.S. waters include commercial and recreational fishing operations, increases in municipal and industrial discharges, and Alaskan and foreign-import tankering. As a consequence of these factors, whiting populations experience wide fluctuations in abundance.

The Pacific whiting is a long-lived species (up to 17 years, but typically 8-12 years), with several year classes contributing to the adult population and commercial fishery at any given time. However, year class strength of whiting is and has been highly variable MBC, 1986). Strong year classes occur every 3-4 years, apparently correlated with favorable environmental conditions during critical spawning and early larval development (PFMC, 1987).

Domestic and foreign commercial fishing pressure is expected to continue on Pacific whiting subpopulation offshore the Pacific Region over the next 35 years. The annual commercial catch has averaged approximately 125,000 mt (PFMC, 1987) over the last 20 years, but has generally been decreasing since 1980. The subpopulation is considered healthy at present, and if strong year classes are assumed to occur periodically every 3-4 years, then it is likely that annual catches of whiting over the next 35 years will fall within the range observed in the past 20 years.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in Section IV.D.1.c). Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986). Although greater strides will be made to decrease or at least limit the amount of sewage entering the southern California region, with a projected 50 percent increase in the coastal population by the year 2010 (Section IV.D.1.c), it is difficult to be more optimistic than to assume that pollution and its effect on whiting of the Pacific region, especially, of southern California, will do other than maintain its present level over the next 35 years. Whiting populations are less subject to sewage outfall than more shallow water fish species, since whiting are typically located in more offshore areas not subject to sewage to the extent of nearshore areas.

Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms are expected to occur at some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time.

The 17 added platforms and 120 additional miles of pipeline corridors could lead to reductions in fish populations if critical habitats are lost. Similarly, nearshore projects such as the Los Angeles/ Long Beach Harbors expansion project should be considered. Although these projects could result in changes to the diversity and abundance of certain fish species inhabiting nearshore or bay habitats, whiting populations frequent offshore areas and are not likely to be impacted. The placement of manmade structures during exploration and development in the 87-track area offshore construction, would have only temporary impacts on whiting populations due to increased turbidity during some construction operations. These impacts would last the several weeks of the drilling or pipeline laying procedure and would affect individual fish. Whiting populations will be unaffected at the local and regional level. Although the platforms and pipelines would remain for approximately 30 years, manmade structures are not expected to cause any detectable decreases in whiting populations since the number of structures anticipated and the area subject to possible disturbance from platform installation remains very low relative to the large areas of similar depth and other environmental conditions available.

Effluents and discharges from the added wells may cause localized and short-term (minutes to hours) changes in the distribution of adult whiting if fish avoid the discharge plume, but due to a very low level of contact, is not expected to cause any discernible impacts that would reduce population levels in the region. Whiting populations are widely dispersed throughout southern California and are generally most abundant at depths of 50-100 m. Based on the broad depth and geographic distribution of all life-history stages throughout southern California and the fact that discharges are expected to occur intermittently and be rapidly diluted close to the drilling sites, only a relatively small proportion (percent) of the egg, larval, juvenile, or adult stages occurring in the region are expected to come into contact with drilling discharges.

In the Alaska Region, there currently are no oil and gas activities in Federal OCS waters, although producing offshore leases do exist in State waters in the Cook Inlet and Beaufort Sea. The cumulative-case scenario for the Alaska Region assumes the construction of 21 platforms in OCS waters over the 35-year life of the proposed action. The number of platform removals expected during this period has not been estimated. Eighteen of these platforms are expected to be located in the Arctic and Bering Sea Subregions. No disruption of whiting populations are expected in the Alaska Region from normal operations, largely because of the extremely small populations of whiting in the area together with the reasons mentioned above for the California populations.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on Pacific whiting populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under (Section IV.D.c(3)), Pacific Marine Mammals, Threatened and Endangered Cetaceans. That description includes assumptions regarding oil spill occurrence, source, and size.

Impacts on whiting populations from oil spills have been discussed in Section IV.D.1.a(6). It is highly unlikely that an oil spill in southern California would contact and impact a substantial portion of these sensitive life stages, because whiting eggs and larvae are widely distributed throughout southern California, occur primarily offshore rather than in nearshore waters, and are most abundant at depths well below the water surface (approximately 50 m). Pelagic juvenile and adult whiting also occur throughout southern California, and much of the Pacific region, but neither a substantial portion of the subpopulation nor its prey are likely to come into contact with the oil spill, since they normally occur at depths well below the water surface (90-100 m in daytime to 20-40 m at night) and are widely dispersed offshore. Possibly effective in further preventing impacts a mile or more from the spill would be the process of dilution, weathering, and containment of oil spills. Similar impacts will occur when oil contacts the Washington, Oregon and northern California off-shore subpopulations of Pacific whiting. Impacts would not be discernible from natural variations of whiting populations both locally and regionally.

As suggested in Section IV.D.1.a(6), the Pacific whiting population in Alaska is inconsequential, forming an unimportant, although not threatened or endangered portion of the pelagic community. Due to the vertical distribution of the population, mentioned above, together with their small numbers, it is unlikely they would be contacted by an oil spill. Impacts from the Alaskan oil spills, therefore would not be distinguishable from natural population fluctuations, if impacts were to occur at all.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). In the Alaska Region, it is assumed that as many as 1,938 oil spills of 1-50 bbl and 79 spills of 50-999 bbl will occur over the life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above. Impacts to Pacific whiting populations would not be discernible, if they occur at all.

In summary, domestic and foreign fishing pressure is expected to continue, but not decrease annual catches from those of the previous 20 years. Although municipal and industrial sewage discharge will continue over the next 35 years, whiting populations are typically located in more offshore areas not as subject to sewage as nearshore areas.

Impacts to Pacific whiting populations within southern California from routine OCS activities associated with the proposed action are expected to be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. Impacts caused by oil spills are expected to result in lethal or sublethal effects that would not be discernible from natural variation of steelhead trout populations within the affected area.

CONCLUSION: Pacific whiting populations in the Pacific Region are expected to continue at highly fluctuating levels for the next 35 years. The largest anthropogenic pressures on whiting populations will come from domestic and foreign commercial fishery pressure. The impacts to Pacific whiting populations within southern California from the cumulative routine development activities are expected to be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. Impacts from spills (1,000 bbl or more) are expected to result in a low number of deaths or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

4) Other Fish Resources

Factors that may produce cumulative effects on fish resources in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to fish resources in U.S. waters include increases in municipal and industrial discharges, commercial and recreational fishing operations, and Alaskan and foreign-import tankering. Even without the proposed action, fish resources are expected to decline due to man-induced stresses superimposed upon (and possibly reinforcing) unpredictable natural fluctuations in populations sizes.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in Section IV.D.1.c. Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986). Although greater strides will be made to decrease or at least limit the amount of sewage entering the southern California region, with a projected 50 percent increase in the coastal population by the year 2010 (Section IV.D.1.c), pollution and its effect on fish of southern California will remain at its present level over the next 35 years.

Fishing pressure exerted by the combined efforts of commercial and marine recreational fishermen is probably one of the most important man-induced stress on some fish resources. Large volumes and numbers of fishes are harvested annually for income, consumption, and/or pleasure (see Section III.C.3). Some particularly desirable fish species are already in short supply. Fishing pressures are expected to remain high as demand for favored species by several user groups increases and fishing practices become increasingly efficient. This will result in continuing short or long term declines in some fish stocks. The duration of impact will depend upon life history characteristics of depleted species, how rapidly stock assessments are made, and how quickly responsive protective actions are taken. In an attempt to ensure that certain fish stocks do not become dangerously depleted, the Pacific Fishery Management Council (PFMC) and/or California Department of Fish and Game (CDFG) regulates harvested quantities, gear types, and seasons for many of these commercially and recreationally valuable species. Modifications to management plans and regulations are made on a continuing bases in response to population fluctuations. The CDFG intends to pursue an ambitious program of artificial reef building to augment fish populations (and thereby improve fishing success) in a variety of nearshore areas within the Southern California Planning Area. While reefs (and other manmade structures including oil platforms, oil islands, and pipelines) are known to concentrate fishes either by attraction and/or enhanced productivity, they will also have the tendency to concentrate fishermen. While local increases in fish abundance might be expected, unless fishing is regulated at some sites it is likely that any increase in abundance of fishes will be offset by subsequent increases in mortality due to fishing. Despite the potential positive attributes of artificial reefs or manmade structures, any benefits from these existing or proposed structures will be offset by their limited distribution and size, proportionate increases in fishing pressure, and ongoing removal of some structures (e.g., abandoned platforms). Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms are expected to occur at some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time.

The 17 added platforms and 120 additional miles of pipeline corridors could lead to reductions in fish populations if critical habitats are lost. Similarly, nearshore projects such as the Los Angeles/Long Beach Harbors expansion project could result in changes to the diversity and abundance of fishes inhabiting nearshore or bay habitats if spawning or nursery habitats within the harbor deteriorate or are lost. The analysis for the base-case scenario (Section IV.D.1.a(6)) concluded that placement of manmade structures during exploration and development in the Proposed Sale Area is not expected to significantly affect fish resources. Thus, the proposal is not expected to increase the total cumulative effect on fish resources from construction of manmade structures.

Effluents and discharges from the added wells are likely to cause additional sublethal or lethal impacts to a few individuals near (within several hundred meters) each drilling site (see discussion above). However, it is unlikely that enough additional wells would be drilled near any one fish species or drilled near critical habitat or spawning areas to cause a significant decline for any single species or assemblage.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on fish resources. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

Impacts on fish resources from oil spills have been discussed in Section IV.D.1.a(6). Acute stresses to fish resources induced by oil spills may compound chronic effects of oily discharges from bilge and fuel oils, marine terminals, municipal and industrial wastes and runoff. A large spill in spring or winter which contacted one or more dense spawning schools of the principal forage prey anchovy, and herring, or squid could directly affect local populations, possibly killing enough individuals within the affected area to cause a measurable reduction (less than 10 percent) in the regional population size. A significant change in the abundance of these species could also affect local abundance of other species, since anchovy, herring and squid are such an important prey species in near-shore coastal pelagic waters. Locally, predator species could experience a slight (less than 10 percent) decline in population size as a response to the change in anchovy or herring availability. Impacts to local anchovy and herring populations are likely to be temporary (less than two years) as replacement stock will arrive quickly from abundant and mobile stocks from unaffected areas of the region. The tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for two to four years.

Considering all potential sources of spilled oil in the marine environment of southern California, at least some impacts on fish populations can be expected to occur although it is difficult to assess the actual level of such impacts. With the multiple spills expected, some will contact fish populations in near shore, shallow water habitats, somewhat greater impacts could occur. Because of their relatively high abundance in nearshore areas, fish such as white croaker and queenfish or the various species of rockfish along with anchovy, grunion, and halibut at certain times of year, could suffer local impacts limited to the area of contact, involving 10-20 percent reductions, but with no discernible indirect effects on trophically dependent species. Recovery would be expected to require 2 to 5 years.

Because of the widespread distribution of most fishes in southern California, the impact of spilled oil on fish populations would probably involve less than a 10 percent reduction in the population sizes of a few species (less than 10 percent of the number of species present) with no discernible indirect effects on trophically dependent species. Recovery from this disturbance to previous population levels is less than two years. Therefore, impacts from the 17 assumed spills will not be discernible from normal population fluctuations within southern California or the Pacific Region overall.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). Considering the widespread distribution of fishes (all life stages) in the study area and the extremely localized, short-term effects of very small spills which have typically occurred in the region, discernible impacts to fish resources are not expected.

In summary, fish resources would be expected to continue to decline in the area from a combination of commercial and recreational fishing pressures, municipal and industrial swage discharges largely caused both directly and indirectly by human population increase particularly in the large metropolitan areas of southern California. Routine activities associated with the proposal could result in reduction of some local fish papulation, but wit no lasting affects on tropically dependent species Recovery of affected local populations would occur within 2 years. Oil spill impacts on fish population is expected to involve less than a 10 reduction in the population sizes of a few species (less than 10 percent of the number of species present) with no discernible indirect effects on tropically dependent species. Recovery from this disturbance to previous population levels is less than two years. The tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for 2 to 4 years.

CONCLUSION: Fish resources will continue to decline during the next 35 years. The primary causes of the decline will continue to be from commercial and recreational fishing pressure and domestic and industrial pollution, particularly near large metropolitan areas. Impacts from routine

OCS operations or accidental spills are not expect to be discernible from normal population fluctuations within the Pacific Region overall.

(d) Atlantic Region

Cumulative impacts on fish resources are evaluated by estimating impacts resulting from the following activities and events not related to OCS gas and oil activities: commercial, industrial, and residential coastal development resulting in habitat loss; pollution in coastal areas, including ocean dumping and dredge spoil disposal; commercial and recreational fishing; and large accidental hydrocarbon spills. Accidental spills may result from non-OCS tanker traffic, involving transportation of domestic and imported crude oil and refined products through the waters along the Atlantic coast. The number, size, and location of oil spills have been discussed previously.

Loss of estuarine and coastal wetlands to commercial, residential, and industrial development has, over the years, reduced nursery and spawning habitat of estuarine-dependent shellfish and finfish. For discussion of coastal habitats in the Atlantic Region, see Section III.D.2.c. Along the Atlantic coast, estuarine wetland loss was greatest in New Jersey prior to the beginning of Federal regulation in 1971, when annual coastal wetland loss there declined by about 98 percent.

Detailed information on commercial and recreational fisheries in the Atlantic Region is provided in Section III.D.3.b and IV.D.1.a(11). Stocks will be subjected to death because of fish taken by fishermen. Overfishing of a species occurs when excessive bycatch of the species is taken in a fishery for another species. Overfishing also occurs when a species is taken in excess in a fishery directed at the species. In either case, overfishing can cause serious impacts.

Section III.D.3.a(3) contains detailed descriptions of shipping activities within the Atlantic Region. A spill of 30,000 bbl from a tanker at the mouth of Delaware Bay is analyzed here. The major fish habitat at risk is inshore estuarine nursery habitat. Recovery of offshore and high-energy inshore areas is expected to be rapid but recovery of fish utilizing polluted quiet shoreline nursery areas may take about 2 to 12 years. Nevertheless, in the cumulative case, the total area affected by 13 spills (including vulnerable shoreline habitat) occurring during the 30-year time span considered here would be so small that no measurable impacts on whole populations of fish resources are expected.

Drill muds and cuttings from 210 wells are assumed to be discharged under this scenario. Impacts on organisms in the water column are expected to be minor because of low toxicity and rapid dilution of drilling muds. Lethal or sublethal impacts on ichthyoplankton may occur on the order of 10's or 100's of meters from the points of discharge. Most impacts are expected to result from local burial or smothering of benthos by drill cuttings. As described in Sections IV.D.1.a(6) and IV.D.1.b(6), the area affected is expected to be small in comparison to the total area supporting benthic organisms.

The approximate volume of potable water used, amount of sanitary waste generated, and effluents discharged, per day, by various OCS activities are summarized in Sections IV.D.1.a(6) and IV.A.1.b. Wastewater will be discharged from the nine platforms and drilling rigs for 50 exploration/delineation wells during the 30-year period. Sublethal effects on planktonic food organisms could occur up to 15 meters from the points of discharge before substantial dilution is assumed.

Four gas pipelines for a total of about 644 km (400 mi) are assumed for the cumulative scenario. As discussed in Section IV.D.1.b(6), about 2.1 km^2 (0.8m^2) of bottom area is expected to be disturbed by pipelaying in water less than 60 m where pipeline burial is required. In contrast, the total area occupied by benthic animals, as described in Section IV.D.1.a(6), exceeds this value by up to 5 orders of magnitude. Thus, no impacts on whole populations of shellfish or the demersal predatory fish that feed on benthic organisms are expected.

Installation of the nine platforms assumed under this scenario is expected to disturb a total of about 7.2 km^2 (2.7 mi^2), the area occupied by all 9 platforms. Removal of these platforms are required. If explosives are used, some fish within 2.7 km^2 (0.9 mi^2) may be injured or killed.

The expected effects of airguns used in geophysical surveys on crab larvae and fish are discussed in Section IV.D.1.a(6). Lethal effects are generally not expected but could occur at close range, i.e., within about 1.5 m (5 ft) of airguns.

Man-made sounds may interfere with some fish behavior, but because of fish avoidance reactions and rapid dissipation of sound with distance, as discussed in Section IV.D.1.a(6), such noise is not expected to depress fish stocks. Similarly, the effects of drilling rig and platform lights on upward feeding migrations of mesopelagic fishes (discussed in Section IV.D.1.a(6)) are expected to be absent or limited to the area near the lights. In summary, sound and light are not be expected to depress whole populations of fish.

Produced water discharge rates of 118 to 36,500 bbl per production platform per day have been recorded, 3.1 MMbbl of produced waters may be discharged from one well, (as indicated in Section IV.A). The general expected impacts of produced water are summarized in Section IV.D.1.a(6). Substantial dilution of any hypersaline produced water would occur within several meters of the discharge pipe, but the large volumes discharged could osmotically stress fishes (especially ichthyoplankton) near the point of discharge where such dilution would not occur.

The general effects of oil spills on fish are summarized in Section IV.D.1.a(6). For this scenario, 23 oil spills of up to 50 bbl and one spill between 50 to 1,000 bbl are assumed to occur. The major impact of a small spill will occur if a low-energy shoreline habitat such as a salt marsh is contacted and the oil accumulates and persists in the sediments. Recovery of fish using such areas (which include estuarine nursery areas) from oil spills may take up to 12 years. A small oil spill is expected to contact individual eggs and larvae of open-ocean pelagic species, shelf-spawning estuarine-dependent species, or shelf species. Sublethal or lethal effects on individual organisms at any stage of the life cycle could occur. However, oil beneath a slick is expected to have low toxic effects, and consequently it is not expected that whole populations would be measurably affected.

Impacts on Atlantic calico scallop beds and live bottom areas that could result are discussed in Section IV.D.1.a(6). Impacts to benthic organisms in such habitats could result from the following activities assumed under this scenario: pipelaying, including about 215 km of trunkline assumed to be in water less than 60 m deep where burial would be required; discharge of cuttings from 50 exploration and delineation wells and 160 development and production wells; emplacement of anchors for drillships required for drilling the assumed 50 exploration and delineation wells; and emplacement of 9 platforms over the 30-year life of the proposal.

Individual organisms are expected to experience sublethal or lethal impacts. Among the more serious impact-producing factors affecting this resource are overfishing, degradation and loss of essential nursery, forage, and cover habitat. The expected duration of impacts is less than 1 generation or 1 to 3 years, except that recovery of fish using shoreline habitat may take 2 to 12 years; entire stocks affected by some non-OCS activities may take 10 years to recover, and without successful mitigation, stock depression from habitat loss will be permanent. Any reduction in fish production due to coastal wetland loss is expected to be permanent unless successful mitigation such as wetland creation occurs. Stocks may be depleted by overfishing due to directed fisheries or excessive bycatch, or depressed by pollution; recovery of such stocks may take 1 to several years, depending on the species. Recovery of fish using shoreline habitats from a spill greater than or equal to 1,000 bbl is expected to take about 2 to 12 years.

CONCLUSION. Individual organisms are expected to experience sublethal or lethal impacts. The most serious impact-producing factor is expected to be overfishing. The expected duration of impacts is less than 1 generation or 1 to 3 years, except that recovery of fish using shoreline habitat may take 2 to 12 years; entire stocks affected by some non-OCS activities may take 10 years to recover; and without successful mitigation, stock depression from habitat loss will be permanent.

(7) Impacts on Reptiles

(a) Gulf of Mexico Region

This cumulative analysis considers the present status of populations, and migratory habits of threatened and endangered marine turtles, and the effects of impact-producing factors related to coastal construction and urbanization; dredge and fill operations; coastal pollution; meteorological conditions; commercial fishing; hopper dredge operation; recreational boat traffic; human consumption; State oil and gas activity; crude oil imports by tanker, and the proposed action, prior, and future OCS sales that may occur, and adversely affect those populations. These impact-producing factors and their effects are discussed in detail in Section IV.A.

It is assumed that the migratory behavior of marine turtles expose them to potential adverse impacts generated from all Gulf of Mexico and Atlantic OCS planning areas, as well as routine and accidental events originating from Central America, North America, Europe, and the Caribbean. Both mortalities and sublethal effects on migrating marine turtles are expected from this multitude of activities. The incremental contribution of each adverse influence on marine turtles cannot be determined; however, the effects from such a potentially large number of adverse sources would cause the partial loss of populations or species of marine turtles within the Gulf of Mexico Region. Should the adverse effects cease, the affected populations or species would stabilize (not increase) within two to three generations.

Marine turtles can become entangled in monofilament fishing line, netting, six-pack yokes, etc., which may result in injury or death. Marine turtles are known to be attracted to floating plastic debris because of its resemblance to their preferred food the jellyfish. Ingestion of plastic and styrofoam materials could result in sublethal effects such as lacerations, digestive disorders and reduced mobility and in deaths as a result of drowning, digestive blockage, and starvation (Balazs, 1985; Carr, 1987a, b; USDOC, NOAA, 1988e; Heneman and the Center for Environmental Education, 1988; and the USDOI, MMS, 1989a. The MMS prohibits the disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR 250.40). In addition, MARPOL, Annex V, Public Law 100-220 (101 Statute 1458), which prohibits the disposal of any plastics at sea or in coastal waters, went into effect January 1, 1989. It is assumed that the combination of lessees obeying special MMS prohibitions and enactment of MARPOL, Annex 5, greatly reduces if not eliminates future OCS-related loss of trash and debris. The effect on marine turtles from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 turtles. In addition, trash and debris that affects marine turtles find their way into the Gulf of Mexico from both commercial and recreational water traffic in the Gulf, South and Central America, and North Africa. The volume of marine debris from these sources is unknown but estimated to be substantial (USDOC, NMFS, 1989a; Heneman and the Center for Environmental Education, 1988). Both deaths and sublethal effects on marine turtles are expected from these sources. The incremental contribution of each source of trash and debris cannot be determined; however, the effects from such a multitude of potentially adverse sources would cause the partial loss of populations or species of marine turtles within the Gulf of Mexico Region. Should the adverse effects cease, the affected populations or species would stabilize (not increase) within two to three generations.

Coastal construction and urbanization, dredge and fill activities, pollution, and meteorological conditions of natural catastrophe can cause the loss of marine turtle habitats, e.g. nesting beaches, nearshore wetland areas, and live-bottom communities. Operations such as commercial fishing, hopper dredge activities, nearshore boat traffic, and harvest of eggs and adults for human consumption directly impact marine turtles.

An unknown but substantial amount of coastal construction is possible due to further urbanization, especially in the northwestern and northeastern Gulf of Mexico. Coastal development falls under the jurisdiction of individual states. However, it is expected that coastal urbanization will cause a loss of nesting habitat, interference with nesting, and disorientation to fledgling marine turtles after hatching. It is expected that this loss/disturbance will result in a decline in populations or species resulting in a change in distribution and/or abundance of marine turtles within the Gulf of Mexico. Should coastal urbanization cease, the affected populations or species would stabilize (not increase) within two generations.

Dredge and fill activities occur throughout the nearshore areas of the United States. They range in scope from propeller dredging by recreational boats to large-scale navigation dredging and fill for land reclamation. Coastal pollution resulting in loss of turtle grass beds includes the alteration of salinity, as in Florida Bay and Mississippi Sound, as well as man-induced increases in turbidity witnessed in Tampa Bay. Disturbances to nesting beaches occur from a variety of sources, including construction, vehicle traffic, and depravation of sand. Meteorological conditions of natural catastrophe including storms, floods, droughts, and hurricanes can result in substantial damage to sea turtle habitat. Sublethal effects on marine turtles are expected from these activities. It is expected that dredge and fill activities, coastal pollution, and natural catastrophes will cause the partial loss of populations or species of marine turtles or minor portions of critical habitat within the Gulf of Mexico Region. Should the adverse effects cease, the affected populations or species would stabilize (not increase) within one to two generations.

Drowning that results from forced submergence in commercial fish trawl has a substantial effect on marine turtle populations in the Gulf of Mexico. Shrimp trawling in the southeastern United States has received extensive scrutiny because of its incidental turtle catch. The NRC (1990) has identified shrimp trawling as the greatest cause of human-induced mortality in marine turtles. The use of Turtle Excluder Devices is legislatively mandated in order to decrease losses. Dismemberment of turtles by hopper dredging has resulted in turtle mortalities. Specific dredging projects include the Canaveral Ship Channel in Florida, the King's Bay Submarine Channel in Georgia, and channel dredging of ports throughout the Gulf. Data from the Sea Turtle Stranding Network indicate a large number of marine turtles are hit by boats. In the northeastern Gulf, the incidence of stranded marine turtles exhibiting indications of vessel collision has been related to the volume of recreational boat traffic. However, the number of mortalities caused by collisions is unknown. The human consumption of marine turtle eggs, meat, or by-products occurs worldwide (Mack and Duplaix, 1979; Cato et al., 1978). Human use is probably substantial but the frequently illegal nature of the activity suggests unreliable estimates of mortality. Both mortalities and sublethal effects on marine turtles are expected from these activities. It is expected that hopper dredge activities, nearshore boat traffic, and harvest of eggs and adults for human consumption will cause the partial loss of populations or species of marine turtles within the Gulf of Mexico Region. Should the adverse effects cease, the affected populations or species would stabilize (not increase) within two to three generations.

A number of activities associated with State oil and gas operations could impact marine reptiles. These would include routine operational discharges and accidental spills; infrastructure construction and emplacement activities; support vessel traffic; pipeline activities; coastal geophysical and platform removal activities using explosives; and transport, storage, and disposal of oilfield wastes. The effects on marine reptiles would be similar to those discussed in the base case and below.

Anchoring, structure installation, pipeline placement, dredging, and operational discharges have the potential to adversely affect marine turtle habitat through destruction of wetlands, nesting beaches (barrier islands), seafloor habitats, and inhibition of feeding offshore. Effects to habitats from the above mentioned impact-producing factors are described and analyzed in detail in Sections IV.D.1.c(8) and IV.D.1.c(9). To summarize the effects on wetlands and estuaries, it is expected that several thousand hectares of coastal areas will be affected over a 45-year period by large and small oil spills as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. An estimated dieback of up to 2,000 ha of wetlands mainly along the Texas and Louisiana coasts will occur for one to three growing seasons from contact with spilled oil. Up to several hundred hectares of wetlands and estuaries could be eroded as a result of maintenance dredging and deepening of navigation channels in coastal Louisiana. Eight new pipeline landfalls will affect a total of 54 ha of wetlands along the south Texas, the mouth of the Mississippi River, and in the Mobile, Alabama areas. The main cause of wetland and estuary loss within the Gulf of Mexico is sediment deprivation and rapid coastal submergence. To summarize the effects on nesting beaches, it is expected that minor changes in beach profiles will occur as a result of oil spill cleanup operations that remove some sand from the littoral zone. Pre-spill configurations are expected to be reestablished within two to four months. Recreational usage of accessible beaches near large population center, such as in Texas and Florida, will result in damage to beach features. The main cause of nesting beach loss within the Gulf of Mexico is the reduction in sediment being delivered to the coastal littoral system, rapid rate of relative sea level rise, and continued coastal urbanization. To summarize the effects on seafloor habitats, little or no damage is expected to the physical integrity, species, diversity, or biological productivity of topographic features. Small areas of 5-10 m^2 would be affected for less than two years, probably on the order of four weeks. However, damage to is expected to one or more components of physical integrity, species, diversity, or biological productivity regionally common habitats or communities of live bottom areas. Fewer than five live bottom areas of 5-10 m^2 would be affected for 10 years. Offshore operational discharges are not lethal to marine turtles and are diluted and dispersed rapidly within one km of the discharge point to the extent that adverse effects to marine turtle food sources do not occur (API, 1989; NAS, 1983). It is expected that effects on marine turtles from anchoring, structure installation, pipeline emplacement, and dredging will be indistinguishable from the long-term (25-50 years) natural variability within populations of marine turtles. It is expected that marine turtles will avoid 5-10 m^2 of topographic feature areas for up to a month and that this avoidance of impoverished foraging areas will have no effect on marine turtles. It is expected that marine turtles will avoid 5-10 m^2 of live bottom areas for up to 10 years and that this avoidance of impoverished foraging areas will have no effect on marine turtles. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of marine turtles to visually locate its prey within one km of the discharge point for the short time period (less than one hour) spent traversing the plume.

Explosive platform removals can cause sublethal effects on marine turtles such as capillary damage, disorientation, and loss of motor control (Duronslet et al., 1986). The effects out to 150 m from the detonation site are primarily sublethal and of a temporary nature lasting less than a week; however, endangered and threatened cetaceans within 50 m to detonation would likely sustain fatal injuries. Mortalities and fatal injuries have been speculated but none have been documented. Although marine turtles occur near offshore oil and gas structures, aerial surveys in the northcentral Gulf have shown no statistical correlation between marine turtles and offshore structures, except near the Chandeleur Islands, Louisiana (Lohoefener, pers. comm., 1989). In order to minimize the likelihood of removals occurring when marine turtles may be nearby, the MMS has issued guidelines for explosive platform removal to offshore operators. These guidelines include daylight detonation only, staggered charges, placement of charges five m below the seafloor, and pre- and post-detonation surveys of surrounding waters.

It is estimated that about 3,120 production platforms will be removed using explosives from the Gulf of Mexico as a result of the proposed action plus those related to prior and future OCS sales. Peak year estimates are on the order of 160 removals, Gulfwide. It is assumed that platform removals will occur both on the OCS and beyond the shelf break. As benthic feeders, Gulf of Mexico hard shell marine turtles do not utilize habitats beyond the shelf break. Although the pelagic life stages of all marine turtles do utilize these habitats, there is no correlation between marine turtles and the presence of offshore structures beyond the shelf break. It is expected that structure removals will cause sublethal effects on marine turtles of a short-term nature lasting less than one week from 50 to 150 m of the detonation site. No mortalities are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e appendix B).

Noise from service-vessel traffic may elicit a startle reaction from marine turtles within 15 m of the vessel. Service vessels could collide with and directly impact marine turtles.

Vessel-related injuries were noted in nine percent of the marine turtles stranded in the Gulf of Mexico during 1988 (USDOC, NMFS, 1989b). Marine turtles spend no more than four percent of their time at the surface, and less time than that during the winter (Byles, 1989; Lohoefener et al., 1990). It is estimated that about 12,000 service vessel trips per year will be completed in support of the proposed action plus those related to prior and future OCS sales. Although a low percentage of stranded marine turtles have shown indications of vessel collision, it cannot be determined what types of vessel where involved and if these injuries occurred before or after death. It is assumed that service-vessel traffic and marine turtles will rarely be in close proximity. OCS-related vessel traffic is less than five percent of the total vessel traffic in the Gulf of Mexico. Marine turtles are known to spend less than five percent of their time at the surface and to actively sound upon vessel approach. In addition marine vessel operators can avoid marine turtles. The startling effect from a vessel is sublethal and at worst of a temporary nature lasting less than an hour. The effects on marine turtles from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)).

It is assumed that there will be contact between marine turtles and spilled oil as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. It is expected that the extent and severity of effects from oil spills of any size will be lessened by improved coastal oil spill contingency planning (Appendix D). In the event that oiling of marine turtles should occur from oil spills (greater than or equal to 1,000 bbl), the effects would primarily be sublethal causing skin and eye irritation, choking from inhalation of toxic fumes, and food reduction or contamination; fewer than 10 deaths are expected. The effects of small oil spills (less than 1,000 bbl) are expected to be solely sublethal due to the inconsiderable area affected and their rapid dispersion. The effect on marine turtles from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths. All individual deaths from spilled oil will be replaced through natural recruitment within two to three generations.

Oil spill response activities such as vehicular and vessel traffic are assumed to affect marine turtle habitat in the event these habitats are contacted by a oil spill of 1,000 bbl or greater. Few adverse effects are expected due to the particular consideration these habitats receive during oil spill cleanup to minimize effects from traffic during cleanup activities and to maximize protection efforts to prevent contact of these areas with spilled oil. It is estimated that several thousand hectares of coastal areas will be affected over a 45 year period by large and small oil spills as a result of the proposed action, prior and future OCS sales, and State oil and gas activities. It is assumed that areas of coastline totaling less than 500 ha will experience oiling during any single year. As discussed above minor changes in beach profiles are expected to occur as a result of oil spill cleanup operations that remove some sand from the littoral zone. Pre-spill configurations are expected to be reestablished within two to four months. It is expected that marine turtles will avoid an estimated 500 ha of coastal areas per year for up to a month and that avoidance of oiled areas will cause have no effect on marine turtles. It is expected that the effects from oil spill response activities would be sublethal to marine turtles causing no discernible decline in a population or species, resulting in no change in distribution and/or abundance. Individuals experiencing sublethal effects will recover in less than one generation.

In summary, a number of activities such as migration behavior, anchoring, structure installation, pipeline placement, dredging, operational discharges, oil spills, oil spill cleanup operations, explosive platform removals, service-vessel traffic, entanglement in or ingestion of trash and debris, coastal construction and urbanization, dredge and fill operations, coastal pollution, meteorological conditions, commercial fishing, hopper dredge operation, recreational boat traffic, and human consumption may adversely affect threatened and endangered marine turtles. The incremental contribution of each adverse influence on marine turtles cannot be determined; however, the effects from such a potentially large number of adverse sources would cause the partial loss of populations or species of marine turtles within the Gulf of Mexico Region. Both mortalities and sublethal effects on marine turtles are expected from trash and debris that find their way into the Gulf of Mexico from both commercial and recreational water traffic in the Gulf, South and Central America, and North Africa. The effects from such a multitude of potentially adverse sources would cause the partial loss of populations or species of marine turtles within the Gulf of Mexico Region. It is expected that coastal construction and urbanization will cause loss of nesting habitat, interference with nesting, and disorientation to fledgling marine turtles after hatching resulting in a decline in populations or species resulting in a change in distribution and/or abundance of marine turtles within the Gulf of Mexico. It is expected that dredge and fill activities, coastal pollution, and natural catastrophes will cause the partial loss of populations or species of marine turtles or minor portions of critical habitat within the Gulf of Mexico Region. It is expected that hopper dredge activities, nearshore recreational boat traffic, and harvest of eggs and adults for human consumption will cause the partial loss of populations or species of marine turtles within the Gulf of Mexico Region. It is expected that effects on marine turtles from anchoring, structure installation, pipeline emplacement, dredging, and operational discharges will be indistinguishable from the long-term (25-50 years) natural variability within populations of marine turtles. It is expected that marine turtles will avoid 5-10 m^2 of both topographic feature and live bottom areas for up to a month and for at least 10 years, respectively, and that this avoidance of impoverished foraging areas will have no effect on marine turtles. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of marine turtles to visually locate its prey within one km of the discharge point for the short time period (less than one hour) spent traversing the plume.

The effect on marine turtles from oil spills is expected to be primarily sublethal and last less than one generation with fewer than 10 deaths. It is expected that marine turtles will avoid an estimated 500 ha of coastal areas per year for up to a month and that avoidance of oiled areas will cause have no effect on marine turtles. It is expected that the effects from oil spill response activities would be sublethal to marine turtles causing no discernible decline in a population or species, resulting in no change in distribution and/or abundance. It is expected that structure removals will cause sublethal effects on marine turtles of a short-term nature lasting less than one week from 50-150 m of the detonation. No deaths are expected due to the MMS guidelines for explosive removals. The effects on marine turtles from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour. The effect on marine turtles from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 turtles.

CONCLUSION: Under the cumulative scenario it is expected that there will be a decline in a threatened and endangered marine turtles population(s) or species, resulting in a change in distribution and/or abundance in the Gulf of Mexico Region. All marine turtles affected by spilled oil will be replaced through natural recruitment within two to three generations. The human consumption of marine turtle eggs, meat, or by-products occurs worldwide and is considered the most damaging to Gulf of Mexico threatened and endangered marine turtle populations. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a(7)) to the cumulative impact is negligible because it is expected that from the proposed action there would be no discernible decline in marine turtle populations, and no change in distribution or abundance.

(b) Pacific Region

Factors that may produce cumulative effects on sea turtles in the Pacific and Alaska Regions include both non-OCS and OCS-related activities. The major source of possible non-OCS oil and gas cumulative impacts to sea turtles in U.S. waters is probably Alaskan and foreign-import tankering.

Sea turtle populations in the eastern Pacific have been greatly reduced by overharvesting and, to a lesser extent, coastal development of nesting beaches in Mexico and Central America (Ross, 1982). As a consequence, three of these species (leatherback, green, and Pacific ridley) are listed as endangered, the fourth (loggerhead) as threatened under the U.S. Endangered Species Act, and all are considered uncommon in Alaska and Pacific Region waters.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on the sea turtle populations. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

It is assumed for the cumulative case that a total of 17 spills (ranging in size from 7,000 to 30,000 bbl) will occur in the Pacific Region over the 35-year life of the proposed action (see Table IV.D.1.c-4). This total includes 5 TAPS tanker spills, 5 import tanker spills, and 7 OCS spills. The OCS total includes a combination of spills from platforms, pipelines, and the tankering of Alaskan OCS oil. Assuming uniform distribution of spills, the average number of spills per year from all these sources is approximately 1 spill every 2 years. For purposes of analysis, it is further assumed that the spills will occur with uniform frequency and spatial distribution within each planning area over the life of the cumulative scenario. The probabilities of one or more of these spills occurring from production in the Alaska and Pacific Regions range from 87 to greater than 99.5 percent.

As discussed in the base case (Section IV.D.1.a(7)), the very low sea turtle densities in the areas affected (particularly in the Alaska Region and in the Pacific Region north of Point Conception) make it unlikely that these animals would be affected by the assumed spills; it mortality does occur, it is not expected to be distinguishable from natural variability within the species' populations.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the large spills discussed above, and are not expected to make a measurable contribution to impacts on sea turtles.

CONCLUSION: The four species of sea turtles found in the eastern North Pacific are all listed as threatened or endangered and are very uncommon in area waters. Overharvesting and coastal development on nesting beaches in Mexico and Central America will continue to be the greatest threat to these populations. Routine activities and accidental events associated with the proposed action (or other OCS activities) are not expected to contribute measurably to cumulative effects on these animals.

(c) Atlantic Region

Assumptions for oil and gas activities in the cumulative scenario are equivalent to those described in Section IV.D.1.b(7) with respect to the number of platforms, wells drilled, support facilities, pipelines, landfalls, and other infrastructure. The major hydrocarbon recovered in this scenario is natural gas.

The existing condition of endangered and threatened marine turtles which occur on the Atlantic OCS are described in Sections III.D.2.d. and IV.D.1.a(7). Non-OCS gas and oil activities affecting marine turtle populations on the Atlantic OCS and which will likely continue to some degree over the 30-years of this scenario include impacts from fishing activities, habitat loss or degradation, human recreational activities on nesting beaches, the bioaccumulation of chemical pollutants such as organochlorines and heavy metals, persistent marine debris such as plastic, and impacts on hatchlings due to beach lighting, beach cleaning, and recreational vehicle use.

Potential impact-producing factors associated with routine gas and oil operations include noise, vessel and aircraft traffic, geophysical surveys, offshore structures, muds and cuttings discharges, and pipeline installation. Other than accidental collisions between vessels and marine turtles, routine potential impact-producing factors are sublethal. Routine impacts which may affect endangered or threatened marine turtles are discussed below. Accidental impacts associated with OCS gas and oil activities include chronic operational discharges and hydrocarbon spills. Due to the importation of foreign hydrocarbons by tanker, spills may occur which may affect this resource but which are not associated with OCS gas and oil activities.

This scenario assumes 23 chronic operational discharges of hydrocarbons (up to 50 bbl). In addition, 1 spill (greater than 50 bbl and less than 1,000 bbl) is assumed. It is further assumed that most chronic operational discharges and the spill will occur offshore at platform sites. Over the 30-year timespan of this scenario, 13 oil spills 1,000 bbl or greater are assumed from existing levels of foreign imports. Eight of these spills will occur offshore in the mid- Atlantic and 1 will occur offshore in the south Atlantic. The four remaining spills are assumed to occur within Atlantic ports. No spills are assumed for the north Atlantic or for the Straits of Florida.

Due to similarities between routine activities and infrastructures assumed under the cumulative and high-case scenarios, the levels of impact for these activities are expected to be comparable (see Section IV.D.1.b(7)).

Impacts due to routine offshore activities are not expected to measurably affect adult or subadult Kemp's ridley, hawksbill, loggerhead, or green turtles due to the preference of these species (or age groups among these species) for inshore habitat. The leatherback turtle, a highly pelagic species, is likely to occur at potential lease sites and will probably contact gas and oil activities occasionally. Although knowledge of the pelagic distribution and seasonal movements of leatherback turtles is incomplete, it appears that the most important geographical area of occurrence is offshore New England. Juvenile green and loggerhead turtles also occur offshore in association with *Sargassum* windrows. The seasonal occurrence and densities of young of these species in potential lease sites, some of which are located close to or on the western edge of the Gulf Stream, is not known.

Although drilling will be the predominant noise source associated with this scenario, it is not expected that underwater noise associated with offshore activities will measurably affect populations of endangered or threatened marine turtles. These animals do not appear to be adversely affected by, or to actively avoid industrial noise sources including offshore gas and oil activities. The drilling of 50 exploration and delineation wells, and 160 development and production wells over a 15- to 20-year period is not expected to result in measurable impacts to populations of endangered or threatened marine turtles on the Atlantic OCS.

The level of possible geophysical survey activities cannot be identified at this time. The discharge of airguns is likely to be the primary impact-producing factor associated with this undertaking. Airgun discharges have been shown to cause avoidance responses among loggerhead turtles under experimental conditions. This suggests that wild sea turtles under natural conditions would also attempt to avoid surveying vessels and potential impacts involving acoustic injuries or collisions with vessels and their towed arrays (see Sections IV.A, IV.D.1.a(7) and IV.D.1.b(7)).

Helicopter traffic will likely result in occasional startle responses among individual turtles. However, this form of impact is short-term, sublethal, not likely to be recurrent on individual animals, and therefore not expected to measurably affect marine turtle populations on the Atlantic OCS.

The volume of muds and cuttings to be discharged as a result of drilling activities in this scenario are 2.3 Mbbl of muds and 0.9 Mbbl of cuttings. As with both the base-case and high-case scenarios, the low toxicity of these muds, rapid dilution in the water column, limited area affected by the discharge plumes, and limited potential for bioaccumulation impacts would not likely produce more than minor short term sublethal impacts. No measurable changes in the population size, distribution, or behavior of endangered or threatened marine turtles on the Atlantic OCS are expected.

A few turtles may be injured or killed due to dredging in waters less than 60 m (198 ft) if this activity were to be undertaken during cold weather when turtles may be present in sediments in an inactive state. The low number of animals which could be killed or injured is not expected to measurably affect the population size, distribution, or behavior of marine turtle populations on the Atlantic OCS.

Along with the expected impacts associated with routine activities, endangered and threatened marine turtles will continue to be subject to non-OCS impacts. Non-lethal impacts include startle reactions due to non-OCS aircraft and vessel traffic (e.g., commercial, military, and recreational), and industrial activities. While documented, the presence of industrial chemicals and their derivatives and metabolites in marine turtle populations is not well understood in terms of impacts it may have at the population level. However, this will likely continue to be a source of potential impacts in the foreseeable future. Loss of habitat or deterioration of habitat quality (e.g., sedimentation and agricultural runoff), largely due to coastal development, is also expected to continue to affect turtle populations. Other activities which could foreseeably continue over the 30 years of the cumulative scenario are lethal or debilitating to marine turtles. At present the most significant source of lethal impact on these animals are nets used by commercial fisheries. Estimates of annual fishing-related mortality in U.S. waters range from 11,000 to more than 40,000 turtles. Although the use of turtle excluder devices (TEDs), designed to release turtles caught in trawls is increasing, a residual level of mortality due to commercial fisheries activities, including impacts due to abandoned or lost gear, will likely continue to lethally impact turtles. Another fisheries-related potential impact source is the commercial harvest of *Sargassum*. Collisions between turtles and vessels (e.g., commercial, military, fisheries, and recreational) result in an unknown number of fatalities and serious injuries (see Section IV.A). Young turtles are also lethally impacted by non-OCS activities. Fatal impacts on emerging turtle hatchlings occur due to beach lighting, beach cleaning, and recreational use of nesting beaches. Although not a problem in areas of U.S. jurisdiction, marine turtles and their eggs are still harvested for commercial and subsistence purposes.

The 23 chronic operational discharges assumed for the cumulative scenario are similar in number to the 21 operational discharges assumed for the proposed action and are expected to have comparable impacts on marine turtles (Section IV.D.1.a(7)). Such chronic discharges (up to 50 bbl), typically of refined hydrocarbons such as diesel fuel, evaporate quickly and are also rapidly dispersed by wind and wave action. Such spills, most of which are assumed to occur offshore, are not expected to measurably affect endangered or threatened marine turtle populations on the Atlantic OCS. The single small spill between 50 to 1,000 bbl occurring offshore would likely affect at most only a few individual turtles. The expected impacts would mostly be sublethal due to the volume of material spilled. Sublethal and lethal impacts resulting from this spill are not likely to measurably affect endangered or threatened marine turtle populations on the Atlantic OCS.

The 13 spills (1,000 bbl or greater) assumed for the cumulative scenario are assumed to occur strictly due to tanker importation of oil and will occur over a period of 40 years. Of the total, 8 are assumed for the mid- Atlantic and 1 for the south Atlantic. All 9 of these spills are assumed to occur offshore. The remaining 4 spills are assumed to occur in mid- Atlantic ports. It is likely that individual sea turtles belonging to the various species present on the Atlantic OCS will be contacted. The nature of the physiological and other direct and indirect impacts caused by oiling are discussed below and in Sections IV.A, IV.D.1.a(7) and IV.D.1.b(7).

The potential for an oil spill (1,000 bbl or greater) to contact marine turtles depends on a number of factors including the size of the spill, the type of oil, and chemical and physical properties such as adhesiveness, the time since the oil was spilled and the rate at which the spilled material is weathering, the location (e.g., offshore, coastal waters, beaches, estuarine areas) and spill trajectory, and the time of year.

Assuming that marine turtles will be contacted by 1 or more of the 13 spills, those animals affected may experience substantial, but not necessarily lethal, impacts. Reactions to oiling under an experimental regime of 48 hours acute and 96 hours chronic exposure in a 0.05 cm (0.02 in) thick surface slick included inflammation of the skin and other soft tissues, blood chemistry changes, salt gland dysfunction and respiratory and digestive system changes (Lutz, 1985). The affected animals all recovered to apparent normal health in 1 month, although in natural conditions animals which were already stressed (e.g., illness, injury, or parasitic burden) may be overwhelmed by the additional stresses of these physiological responses and die.

Whether spilled oil can or will be avoided by turtles has not been resolved. Manton (1979) report on the ability of turtles to detect volatile hydrocarbon fraction at concentrations as low as 10^{-6} M.

Although adults may be oiled and recover from the experience, there are uncertainties regarding the potential impacts of oil on juveniles. Small turtles are known to migrate passively in *Sargassum* windrows. Whether oil spilled offshore would become concentrated along the convergence zones at the western edge of the Gulf Stream where large quantities of this plant is found, and thus contaminate young turtles, is uncertain. In light of the absence of data on this subject it is suggested that oiled juveniles might tend to suffer more lethal effects than older animals were they to contact freshly spilled oil or occupy moderate to heavily oil-contaminated *Sargassum*.

Depending on the spill location, trajectory, time of year, etc., nesting beaches could be contacted by spilled oil. Spills north of Cape Hatteras are not expected to affect nesting activity which is very limited above this latitude. From Cape Hatteras south through the mid- and south Atlantic, the major nesting species is the loggerhead turtle. In the event of a major spill contacting nesting beaches during the nesting season, two groups of turtles would be vulnerable to oiling; the breeding adults in nearshore waters, and developing embryos on the beach. (The vulnerability or susceptibility of individual nests depends on beach morphology, tides, wave energy, nest site selection behavior of the affected species, and other factors). Though potentially lethal, it is expected that the majority of adult turtles affected by oil would recover if these reproductively active individuals would be able to leave the affected area.

Oil spilled during the warm season within important developmental areas (e.g., Chesapeake Bay, Virginia and Currituck Sound, North Carolina, but not Delaware Bay which is too far north) will likely affect subadult turtles and adults. The most vulnerable species, due to its low population size, is the Kemp's ridley. These animals occur only as juveniles and subadults on the Atlantic OCS. As 4 port spills are assumed, it is likely that at least 1 spill in a developmental area during the seasonal presence of subadult turtles could occur. It is expected that while most subadults affected would experience sublethal impacts and recover to apparent health, it is likely that a small number would die. In addition, impacts on the flora and fauna in shallow waters may lead to some degree of bioaccumulation or localized temporary depression of food species abundance. Although some impacts may be measurable within the affected area, at the level of the species' population no measurable impacts are expected.

Even in the absence of special protections, it is unlikely that measurable effects on endangered and threatened marine turtles would occur under the cumulative scenario due to the oil and gas activities alone. No unique, rare, or uncommon ecosystems on which these animals depend occur at or closely adjacent to potential lease sites, with the possible exception of *Sargassum* communities for passively migrating juveniles.

In summary, the endangered and threatened status of Kemp's ridley, the hawksbill, the leatherback, green, and loggerhead turtles are primarily a consequence of prior harvesting and ongoing unintentional commercial fisheries bycatch. Among all endangered and threatened marine turtles the Kemp's ridley is most danger of extinction. The loggerhead population is showing signs of initial recovery. However, several human activities not associated with gas and oil activities continue to affect marine turtle populations. Chief among these activities are impacts due to commercial fishing and coastal development. Both activities are likely to continue to impact marine turtle populations at some level for the duration of the 30-year scenario.

Oil spills are assumed to increase in the cumulative case. In and of themselves it is not likely that these spills, spread over a 30-year period would measurably affect these populations with the possible exception of Kemp's ridley turtle. Though not attributable in any way to the proposed recovery of natural gas on the mid- and south Atlantic OCS, the 13 spills could aggravate the recovery of these species in light of the other impacts which they presently experience. As a result there is reason to consider that the combination of non-OCS gas and oil impacts and non-OCS oil spills would act in a manner to further degrade the condition of endangered and threatened marine turtles.

CONCLUSION: Taken separately, routine and accidental impacts identified under the cumulative scenario are not expected to produce any measurable changes in the distribution, population size, or behavior of endangered and threatened marine turtle populations on the Atlantic OCS. However, non-OCS impacts over the 30-year scenario timespan, unless abated, are expected to result in measurable diminishing of some marine turtle populations.

(8) Impacts on Coastal Habitats

(a) Gulf of Mexico Region

1) Wetlands and Estuaries

Impacts to wetlands can occur from changes in coastal sedimentation and submergence environments, oil and gas activities in State tidelands, barging and tankering of imported crude oil, commercial, residential, and agricultural development of wetlands, and activities associated with the proposed action, prior, and future OCS sales.

Reduction in the amount of sediment reaching the coast has been implicated as a major factor affecting wetlands in coastal Louisiana. In a subsiding coastal setting, mineral sedimentation is needed to maintain the wetland surface at or near sea level. The widespread accretionary deficit observed in Louisiana wetlands is associated with sedimentary deficits, which result in the submergence of wetlands and conversion to open water. The Mississippi River, the largest source of sediments for coastal wetlands, has experienced a 50 percent reduction in its suspended sediment load since 1950. In addition, flood control and navigational improvements along the lower course of the river have created levees along the river that prevent the overbank discharge of alluvial sediments onto adjoining wetlands. The impacts of sediment deprivation in coastal Louisiana on wetlands is compounded by the rapid submergence rates that characterize the coast. Coastal submergence has also been implicated as a causal factor in wetlands loss along the Texas coast (White et al, 1985). The affects of sediment deprivation and coastal submergence will continue over the life of the proposed action to affect coastal wetlands along the Texas and Louisiana coasts.

Commercial, residential, and agricultural development in wetland areas along the Gulf coast will likely diminish over the life of the proposed action because of the increasingly restrictive regulatory environment governing development in wetland areas. Although the rate at which wetlands are being converted to other land uses is slowing, the process still occurs. The rate at which wetlands continue to be converted will vary to some extent from state to state depending on the local regulatory environment. Although, in the past, a large amount of mangrove swamp habitat has been converted to residential developments in Florida, this process has been greatly reduced in recent years as a result of changes in the State regulatory environment. Wetland conversions in Louisiana as a result of onshore State oil and gas development still continues. In 1988, for example, dredging of rig access canals for onshore oil and gas development in wetland areas accounted for the loss of 11 ha of wetlands in coastal Louisiana. In coastal Alabama, the conversion of wetlands for commercial and silviculture purposes has been implicated as the major cause of coastal wetlands loss in the State (Roach, 1987).

Most of the canalization along the Gulf coast has occurred as a result of onshore State oil and gas activities. Louisiana, the state that has experienced the greatest amount of oil and gas activities, serves as an example. An indication of the extent of onshore oil and gas activity is provided by well completion data: approximately 41,190 wells had been completed in coastal Louisiana through 1984 (USDOI, USGS, pers. comm.,1984). Navigational access canals and pipelines to service onshore development are pervasive throughout the coastal region: 15,285 km (9,500 mi) of onshore pipeline canals have been installed to carry tideland production. According to U.S. Army Corps of Engineers permit application data, in 1988 that agency received applications for the installation of 123 km (76 mi) of pipelines through wetland areas to carry tideland production. The average direct impacts from backfilled pipeline canals in coastal Louisiana are 0.91 ha/km. If 123 km of pipelines are installed each year during the 45-year life of the proposed action, about 5,000 ha of wetlands will be converted to open water in Louisiana.

Drilling and production activity at coastal well sites requires rig access canals. Typical dimensions of an access canal, as indicated on permits, are 366 m long by 20 m wide with a 0.5 ha drill slip at the end. In 1988, the COE received applications for the dredging of over 11 km of access canals. If that rate of dredging is projected over the life of the proposed action, the direct impacts from this type of dredging would be the conversion of about 1,000 ha of wetlands to open water and spoil banks.

The erosion effects of non-OCS traffic in navigational channels are difficult to calculate because the OCS figure is based on the first 24 km of the channel. The total length of these channels for general navigation has not been calculated. Given, however, that OCS traffic only accounts for 12 percent of the traffic, along the first 24 km of the channel alone, erosional impacts should exceed 2,000 ha.

Import tanker spills are assumed to occur offshore the Texas and Louisiana/Mississippi/Alabama coasts, based on the locations of refinery facilities in the Gulf. Many of the crude oil spills from import tankers will occur in or near coastal waters. Furthermore, the average size of import tanker spills (30,000 bbl) is larger than the average size of OCS spills. Consequently, more oil from import tankers will contact coastal wetlands. Assuming that 65 percent of the original volume of oil reaches the coast, and that 33 percent of that volume contacts barriers, nearly 6,000 bbl of oil per spill will contact wetlands. Assuming that a 20 meter deep section along 25 km of shoreline is contacted, the concentration of oil on the 50 ha of contacted wetland vegetation will be about 1.8 l/m^2. This concentration of oil is above the level that is believed to result in extensive mortality to wetland vegetation (Webb et al., 1985). Within this area of contact, plant regrowth is expected to occur within one growing season from the rhizomes and roots of the wetland plants over 67 percent of the area. The remaining areas will experience complete plant mortality, and will eventually be revegetated by rhizome expansion from more intact wetland areas or from reseeding. This process will take one to three years. Within the 50 ha area of contact, some of the wetland areas will be permanently lost as a result of erosion along shoreline margins (as noted by Alexander and Webb, 1987), and as a result of an acceleration of local land loss rates in areas affected by spills (as noted by Fischel et al., 1989). It is estimated that about five hectares of wetlands will be permanently converted to open water as a result of each spill. Therefore, the total impact from the 40 import tanker spills is expected to include 2,000 ha of wetlands experiencing temporary plant die back (one to three growing seasons) and 200 ha of wetlands being permanently converted to open water.

The discharge of produced waters into coastal water bodies is only allowed in Louisiana. Approximately 20 percent of the produced waters generated on the OCS offshore Louisiana are discharged onshore. About 3.14 billion bbl of produced waters are projected to be discharged into Louisiana coastal waters over the 45-year life of the proposed action under the cumulative scenario. In 1986, 1,524,962 BPD of produced water were discharged from 682 separation facilities associated with the Louisiana State oil and gas industry (Boesch and Rabalais, 1989a). In this same report, it was estimated that another 823,575 bbl of produced waters from Texas State oil and gas activities were discharged daily into Texas State waters. Field studies have documented no significant impacts to coastal wetlands in the immediate area of a produced water discharge point in Louisiana (Boesch and Rabalais, 1989a, b).

Eight pipeline landfalls are projected to occur during the life of the proposed action and future OCS activity (Table IV.D.1.c-3). Pipeline emplacements can convert wetland habitat to open water and spoil areas, and can result in secondary effects related to the hydrologic changes associated with the canal. Modern pipeline projects are required by permitting agencies to be backfilled which partially to completely fills in the pipeline canal, eliminates spoil banks, and reduces secondary impacts. New pipeline landfalls are expected in the Mobile, Alabama area, near the mouth of the Mississippi River, and along the Texas coast. Impacts to wetlands from pipeline projects are estimated to be 0.68 ha/km. Assuming a 40 km length of the pipeline through wetlands, about 54 ha will be affected. The impacts will include the conversion of wetlands to open water areas in the canal itself, and the destruction of some wetlands along the canal bank where heavy machinery disturbed the wetlands during the excavation and backfilling procedures. These impacts are expected to persist for many years and are assumed to be permanent.

Although no new navigation channels are expected to be dredged, maintenance dredging of existing channels will occur periodically. Continued dredging of channels to maintain channel depth encourages salt water intrusion. Disposal of the dredged material onto existing spoil banks can bury adjacent wetland areas and aggravate the damming effect of the spoil banks on marsh surface drainage. Although the effects of maintenance dredging on wetlands have not been quantified, in Louisiana alone in 1988 the COE received permit applications for maintenance dredging along 130 km access canals, generating 4.5 million m^3 of dredge spoil, most of which was disposed of onto existing spoil banks and adjacent wetlands. In addition, major Gulf waterways are dredged to maintain or increase navigable water depths. In general, it is assumed that the major Gulf waterways are dredged every 1 to 2 years. Although the impacts of this dredging on wetlands cannot be quantified at the present time, it is reasonable to expect several hundred hectares of wetlands to be converted to spoil habitat over the life of the proposed action. Most of these conversion will occur in Louisiana and, to a lesser extent, Texas.

To accommodate deeper draft service vessels for deep water oil and gas operations, some existing navigation channels will need to be deepened. This document assumes that 10 percent of the navigation channels in the Gulf that are used for OCS traffic will be deepened. If the dredged material is disposed of onto spoil banks, additional wetland acreage will be converted. The spoil banks will also cause secondary impacts in the wetlands.

In addition, the waves generated by the passage of OCS-destined vessels through navigation channels by OCS vessels can cause channel bank erosion and wetlands loss, if wetlands occur along the channel margin. In Louisiana, ports and support bases are located within the wide expanse of wetlands on the deltaic plain. Here, navigation channels will be bordered by wetlands over much of their length. In other areas of the Gulf, wetlands typically occur as a coastal fringe. Dredged navigation routes will traverse mainly open water areas with only limited distances through wetland areas. Consequently, the widening of navigation channels at the expense of wetlands will only be a problem in coastal Louisiana.

According to Johnson and Gosselink (1982), channels that have high navigational usage widen about 1.5 m/yr more rapidly than channels that have little navigational usage. An idea of the contribution of OCS oil and gas activities to accelerated channel bank erosion is provided in Table IV.A-1 which indicates that 323,000 service vessel trips will occur over the life of the proposed action. Also, two percent of the oil produced offshore Texas and Louisiana as a result of the proposed action will be barged to shore. Assuming that each barge carries on average 20,000 bbl of oil, about 7,200 barge trips will occur during the life of the proposed action. This analysis assumes that the average distance from the coast to an OCS facility is 24 km. There are 18 navigation channels in Louisiana that are used by OCS vessels. OCS traffic under the cumulative scenario is assumed to account for 12 percent of the total vessel traffic within the channels. Assuming that vessel-related channel erosion results in 1.5 m/yr of wetlands loss along the length of the channel (a maximum estimate because the entire 24 km average length of the channel to an OCS facility will not be bordered by wetlands), a total of about 350 ha of wetlands could be eroded over the 45-year life of the proposed action as a result of OCS activities in Louisiana alone. These wetland losses would be permanent because vessel traffic within the channels will interfere with marsh recolonization.

The only new infrastructure expected to be constructed during the life of the proposed action is one pipe yard and five marine terminals. These facilities will likely be located in the Mobile, Alabama area and south Texas. In these areas, an adequate supply of upland is located near navigable channels. It is likely that these facilities will, therefore, not be constructed on wetlands given the regulatory difficulties in permitting new construction projects in wetland areas and the higher costs of construction in wetlands.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)). That description includes assumptions of oil spill occurrence, spill sizes, and likely contacts with shoreline and wetlands areas.

Based on the offshore source of the OCS oil spills (1,000 bbl or greater), it is assumed that only 25 percent of the oil will remain in the slick at the time of contact. The most likely locations for the occurrence of these spills is offshore Louisiana and Texas because most of the oil producing tracts on the OCS are located there. Much of the coast here is fronted by barrier islands and beaches. Only oil that is transported through barrier passes could potentially contact wetlands. It is assumed that 33 percent of the oil will be moved into estuarine embayments and potentially contact wetlands. Considering all of the losses of oil from the original spill, approximately 2,000 bbl of oil could ultimately contact wetland areas. Assuming that 25 km of shoreline are affected per spill, and that oil moves back onto the wetlands for 20 m, the concentration of oil on the contacted wetland vegetation will be about 0.6 l/m^2. This concentration of oil is below the level that is believed to result in extensive to wetland vegetation (Webb et al., 1985).

The distribution of oil in the wetlands, however, will not be uniform. The oil may be stranded by the ebbing tide at higher concentrations in areas of lower elevation. Die back of above ground vegetation and some entire plant mortality is expected in these areas. Furthermore, these areas will likely experience accelerated rates of land loss, as noted by Fischel et al. (1989). Assuming that one-third of the contacted wetlands will receive high concentrations of oil, approximately 70 ha will be affected as a result of the 2 spills that contact coastal wetlands.

In addition to crude oil spills, 142 petroleum product spills are expected to occur in onshore or nearshore Gulf waters. Of these, 60 percent (85 spills) are assumed to result in contact to the coast. The average size of a petroleum product spill is 11,000 bbl. The distribution of these spills in the Gulf are assumed to be 34 offshore Texas, 46 offshore Louisiana/Mississippi/Alabama, and 5 offshore Florida. Using diesel fuel as the typical petroleum product, spill contacts to wetlands will result in more acute, toxic impacts, but fewer long-term, chronic impacts. This will result in a higher percentage of the contacted vegetation experiencing die back, but the vegetation recovering in a shorter time period than was the case for crude oil. Using the same reasoning process as in the previous paragraphs, each spill will result in approximately 2,000 bbl of petroleum products contacting the coast.

In Louisiana and Texas, these spills will result in the temporary die back of up to 2,000 ha of wetland vegetation. Petroleum product spills that occur offshore the Florida panhandle are not expected to contact wetlands because wetlands here occur in protected settings behind barrier islands at the heads of estuaries and in coastal embayments. Farther to the south, a petroleum product spill could contact mangrove swamp habitat. For example, a diesel oil spill in the Tampa Bay area would contact mainly mangrove swamp. The spill would result in sublethal impacts throughout the area of contact. These sublethal impacts would include defoliation and stunted growth. These impacts could persist for several years. Some tree mortality would occur where contact with the diesel oil was extensive and persisted for a day or more. Assuming that two product spills occur in the Tampa area, and that one contacts the coast, up to 25 ha of mangrove habitat will experience these impacts.

In summary, the decrease in the amount of sediment that is being transported by the Mississippi River and other Gulf rivers is a major causative factor of wetland loss. Sediment deprivation is compounded by the rapid submergence, particularly in Louisiana, that is occurring along the coast. Sediment deprivation and rapid submergence, acting together, are believed to be responsible for much of the wetland loss that is occurring in coastal Louisiana, where the current land loss rate is estimated at 104 km^2/year (Britsch and Kemp, 1990) , and elsewhere in the Gulf. Development of wetlands for agricultural, commercial, and residential uses has converted large amounts of wetlands acreage in the past. Although the rate at which wetlands are being developed for other uses has decreased in the past few years as a result of a changing regulatory environment, some wetland conversions for development purposes will continue through the life of the proposed action. The routine discharge of produced water into coastal waterbodies in Louisiana is not expected to affect adjacent wetlands based on the results of field studies. New dredging and construction projects in wetland areas assumed during the 45-year life of the proposal include eight pipeline landfalls, navigation channel maintenance dredging and deepening, and new infrastructure construction. The eight new pipeline landfalls are expected to affect 54 ha of wetlands along the south Texas, the mouth of the Mississippi River, and in the Mobile, Alabama areas. Maintenance dredging and deepening of navigation channels will affect wetlands mainly in coastal Louisiana where wetlands typically fringe navigation routes. Several hundred hectares of wetlands could be converted to spoil habitat as a result of these activities. In addition, vessel usage of navigation routes will result in the erosion of as much as several thousand hectares of wetlands. The construction of one new pipe yard and five new marine terminals is expected to occur along the south Texas and Alabama coasts where ample amounts of upland acreage occur near the coast. Given the current regulatory environment, it is likely that these facilities will be constructed on coastal uplands rather than wetlands. Impacts from accidental discharges of oil could affect several thousand hectares of wetlands, mainly along the Louisiana and Texas coasts. In the affected areas, damage to wetlands will include temporary (one to three growing season) dieback of the above ground vegetation, some complete plant mortality, and accelerated rates of permanent land loss (the conversion of wetlands to open water).

CONCLUSION: Under the cumulative scenario losses of wetlands are expected to continue to occur along the Gulf coast. The main cause of these losses, particularly in coastal Louisiana where the largest amount of wetlands will be lost, is sediment deprivation and rapid coastal submergence. Several thousand hectares will also be lost as a result of tideland oil and gas development and the erosion of navigation channels into adjacent wetlands in Louisiana, and land development throughout the Gulf region. The relative magnitude of wetlands loss along the Gulf coast would be expected to remain approximately the same even in the absence of the proposed OCS program.

2) Barrier Beaches

In addition to the impacts associated with the proposed action, impacts to barrier beaches can occur as a result of activities associated with oil and gas development in State tidelands, tankering and barging of imported oil, changes in the sedimentary/sea level environment in which the barriers occur, and as a result of recreational and land development along the coast.

Reductions in sediment supply along the Texas and Louisiana coasts have resulted in the erosion of barrier landforms. Dam construction, on the Mississippi River and its tributaries in particular, has trapped sand-sized sediments before they reach the coast. In this sediment-deficient environment, beaches have been migrating landward in response to marine erosional forces. This factor is likely to continue unabated as a cause of barrier erosion during the life of the proposed action. The ongoing rapid rate of relative rise in sea level, particularly along the Louisiana coast, will further exacerbate erosion in the sediment deficient Gulf coastal environment.

The Gulf coast has experienced various amounts of recreational, and land use pressures, depending on the accessibility of the coast to population centers. The Texas barrier islands are used extensively for recreation because of their proximity to shore, their connection to the mainland in many cases, and the large populations that inhabit coastal counties. Recreational usage here has had numerous impacts on beaches including damage to sand dunes from dune buggies (Judd et al, 1988). Most barrier beaches in Mississippi and Louisiana are relatively inaccessible for recreational users either because they are located at a substantial distance offshore, as in Mississippi, or in coastal areas with limited road access, as in Louisiana. Furthermore, many of the barrier islands in Mississippi are part of the National Park System. In Florida, expanding coastal populations and the large number of tourists who visit Florida's beaches have placed recreational pressure on coastal habitats. Pedestrian trampling and off-road recreational vehicles traffic are the most damaging recreational activities. Recreational impacts are expected to continue affect beach areas in parts of Florida and Texas during the life of the proposed action.

Import tanker spills are assumed to occur offshore the Texas and Louisiana/Mississippi/Alabama coasts, based on the locations of refinery facilities in the Gulf. Many of the crude oil spills from import tankers will occur in or near coastal waters. Furthermore, the average size of import tanker spills (30,000 bbl) is larger than the average size of OCS spills. Consequently, more oil from import tankers will contact barrier beaches. Assuming that 65 percent of the original volume of oil reaches the coast, and that 67 percent of that volume contacts barriers, over 13,000 bbl of oil per spill will contact beaches. Assuming that 50 km of coastline is contacted, and that the oil is washed 10 m up the beach face, a 0.4 cm thick layer of oil will be deposited on the contacted beach. Assuming a porosity of 50 percent for beach sand, the oil should penetrate into the beach to a depth of a few centimeters. By the time that beach cleanup operations began, the oil may penetrate to depths of 6 to 8 cm. This depth of sand would have to be disturbed to remove the oil. The removal of 6 to 8 cm of sand from the littoral zone could result in beach face retreat and erosion as an adjustment to a reduced sand supply, especially along the eroding, sediment starved stretches of coast in the Gulf, such as in coastal Louisiana. This analysis, however, assumes that the sand will be cleaned in place with little to no removal of sand from the littoral zone. If this were done, the spill and associated cleanup could result in short-term adjustments in beach profile configuration, but the pre-spill configurations would be reestablished within a year.

Eight new pipeline landfalls are expected under the cumulative scenario. Likely locations for these landfalls are the Mobile, Alabama and Pascagoula, Mississippi areas, the mouth of the Mississippi River, and the south Texas coast. An MMS study has shown that pipeline landfalls across barrier beaches have resulted in little-to-no impacts (Wicker et al., 1989). Other investigators have monitored pipeline landfall projects on barrier beaches in the Gulf, and have shown that, with proper construction techniques, landfall projects can be done with minor effects on beach topography (LeBlanc, 1985; Mendelssohn and Hester, 1988). Furthermore, the States of Mississippi and Alabama will likely require pipeline landfalls to be routed around barrier islands in accordance with their coastal management policies. Based on all of these considerations, no permanent impacts are expected to barrier beaches as a result of pipeline crossings. Pipeline crossings along the south Texas coast may result in temporary disruption of beach and sand dune configurations and vegetation. With modern construction practices, including regrading beach topography and revegetating sand dunes, these disruptions are expected to persist for one year or less.

No new navigation channels are expected to be dredged through barrier passes; therefore impacts from these activities are precluded. To accommodate deeper draft service vessels for deep water operations, however, it is assumed that 10 percent of the navigation channels will be deepened. Deepening channels through barrier passes could result in interruptions in the littoral transport system and deprive beaches located downdrift from the channel of needed sediments. An MMS-funded study documented localized accelerated beach erosion near navigation channels. It is reasonable to expect some localized erosion downdrift from a few channels as a result of channel deepening.

New infrastructure construction under the cumulative scenario includes six terminals and one pipe yard. Forty-two hectares of land could be affected by these projects. It is unlikely that these facilities will be constructed on barrier features given the existence of ample supplies of nearby land on the mainland, and the regulatory difficulties in permitting new construction on barrier islands. If some facilities are constructed on barrier features, only a small amount of land will be used.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)) That description includes assumptions of oil spill occurrence, spill sizes, and likely contacts with shoreline and wetlands areas.

Based on the offshore source of the OCS oil spills (1,000 bbl or greater), it is assumed that only 25 percent of the oil will remain in the slick at the time of contact. The Louisiana and Texas coastal barriers are discontinuous, and it is likely that as much as 33 percent of the oil will be transported through barrier passes and onto coastal wetlands. Consequently, only about 3,500 to 4,000 bbl of oil will be spread along the barrier coast. It is assumed that about 50 km of beach will be contacted per spill. The removal of large quantities of sand form these beaches during the cleanup process could exacerbate ongoing erosion problems. It is likely, however, that cleanup operations will be used that do not result in the permanent removal of sand from the littoral zone. Based on the observed effects of cleanups along Gulf coast beaches after spills, expected impacts to the beach will consist of minor beach profile changes persisting for time spans of a few tidal cycles to a season (McKinna, 1985). Therefore, no permanent impacts to barrier beaches are expected as a result of occurrence and contact from a large offshore spill.

In addition to crude oil spills, 142 petroleum product spills are expected to occur in onshore or near-shore Gulf waters. Of these, 60 percent (85 spills) are assumed to result in contact to the coast. The average size of a petroleum product spill is 11,000 bbl. The distribution of these spills in the Gulf are assumed to be 34 offshore Texas, 46 offshore Louisiana/Mississippi/Alabama, and 5 offshore Florida. It is assumed that, in general, the petroleum product spills will lighter and more volatile products than crude oil. Consequently, it is estimated that only 33 percent of the original volume of the spill will contact the coast, resulting in about a 1,200 bbl spill spread across 50 km of beach. The lighter nature of the petroleum products may result in deeper penetration into beach sands. It is assumed that these spills will be cleaned with no permanent removal of beach sand, and no resulting permanent alterations in beach configuration.

Contact to barriers from a small spill could occur either on the ocean or landward side. Oil barges frequently use the protected waters behind the barriers for navigation, and many pipelines cross barrier islands before reaching the mainland. The occurrence and contact from several small spills to barriers over the life of the proposed project will result in light oiling of up to two kilometers of barrier beaches along the Gulf coast. It is assumed that these spills will be cleaned with methods that will not result in the permanent erosion of the barrier landform.

No contact to sand dune vegetation is expected to occur as a result of oil spill contacts. The dune vegetation occurs high enough above ordinary high water levels that it is very unlikely that the oil will be carried onto the dunes by the tides. For oil to be carried onto the dune zone, strong onshore winds, such as those that occur during a tropical storm, would be required for adequate wave set-up. These stormy conditions would disperse and spread the oil slick, and reduce the concentrations of oil that would occur along the coast. Furthermore, a recent study has shown that the disposal of oiled sand on vegetated sand dunes in Texas had no deleterious effects on the existing vegetation or on the recolonization of the oiled sand (Webb, 1988). Based on all of these considerations, it is assumed that oil spills will not affect sand dune vegetation.

An issue of concern in the Gulf is the impacts of oil spills on barrier islands that are included in the National Park System. In the Gulf, the Gulf Islands and Padre Island National Seashores in Mississippi and Texas, respectively, are included within the National Park System. No oil spill contact to Padre Island is expected because oil terminals and pipelines are not located in the area. Inshore spills near the Gulf Island National Seashore have occurred in the past from pipeline and oil barge accidents. In fact, a spill in September, 1989 resulted in about 10 bbl of oil contacting about 1.5 km of beach on the landward side of Horn Island. The oil was removed from the beach by water flushing with no removal of sand from the littoral system. No impacts to the morphology of the island were observed as a result of the spill. The spill, however, did result in mortalities to subtidal and intertidal benthic crustaceans along the oiled stretches of the island. Coastal bird populations were observed feeding upon these oiled crustaceans after the spill. No long-term impacts to National Seashores are assumed to occur as a result of the occurrence and contact from a small oil spill.

In summary, sediment deprivation and relative sea level rise will continue to result in rapid retreat of many barrier coasts. These factors will continue to cause coastal retreat over the 45-year life of the proposed action. Maintenance dredging and deepening navigation channels through barrier passes may have erosional impacts on beaches located downdrift from the channels. These impacts will occur, however, only in the immediate vicinity of the channel. Recreational usage of accessible beaches near large population centers, such as in Texas and Florida, will result in damage to beach features, such as sand dunes. New construction associated with OCS activities will include pipeline landfalls and onshore support facilities. Pipeline landfalls will likely cross barrier features in only Texas. Impacts here will be short term (less than one year) disruptions to sand dune vegetation and beach topography in the vicinity of the pipeline. It is likely that new support infrastructure will be constructed on uplands, rather than barrier features. Impacts from the accidental discharges of oil are expected to result in minor changes to beach profiles as a result of cleanup operations that remove some sand from the littoral zone. Pre-spill configurations are expected to be reestablished within a few months. No oil is expected to contact sand dune vegetation.

CONCLUSION: Under the cumulative scenario, the observed erosional trend of barrier features will continue along much of the Gulf coast. The major cause of these impacts is the reduction in sediment being delivered to the coastal littoral system and rapid rates of relative sea level rise. The magnitude of barrier beach erosion along the Gulf coast would be expected to remain almost the same even in the absence of the proposed OCS Program.

(b) Alaska Region

WETLANDS AND ESTUARIES: The primary cumulative effects on coastal wetlands and estuaries in the Arctic are associated with past development of the Distant Early Warning (DEW) Line Stations; mining activities in the Hope Basin; and past, present, and proposed future on- and offshore oil and gas exploration and development. Types of effects involve habitat alterations (especially causeways) and potential oil spills. Primary cumulative effects on wetlands and estuaries in the Bering Sea and the Gulf of Alaska would come from the following activities: commercial fishing, oil tankering, and other freight- and tour-vessel traffic, Federal and State of Alaska oil and gas exploration and development, and mining and logging activities. Primary cumulative effects from the proposal would be from oil spills and habitat alterations.

Seventeen DEW Line Stations were constructed along the arctic coast from Point Hope (Chukchi Sea coast) to Point Barrow and to Demarcation Bay on the Canadian border (Beaufort Sea coast). This development resulted in the local alteration and filling in of wetlands during the construction of gravel pads and airstrips at and near some of the DEW Lines Stations. This very local loss of wetlands at the stations represents a mere fraction of the wetlands on the North Slope. Small fuel-oil spills from 55-gallon oil drums associated with the DEW Line Stations probably had some effects on adjacent wetlands and on wetland invertebrate communities.

The port facilities associated with the inland Red Dog Mine located in the Hope Basin Planning Area have had effects on adjacent wetland habitats. Possible fuel spills associated with this mining port would be an additional source of local effects on wetland-estuarine habitats.

Cumulative commercial-fishing activities in the Bering Sea and Gulf of Alaska have seasonal effects on marine and anadromous fish and shellfish populations occurring in wetland-estuarine habitats and could have several-year effects on some of these populations if overharvest occurs. Commercial fishing is a chronic source of fuel-oil spills that can affect wetland-estuarine habitats. Several fishing-vessel shipwrecks have resulted in sizable fuel-oil spills that contaminated coastal habitats in the Bering Sea. Most of the spills were diesel oil and dissipated quickly with short-term effects on the wetland-estuarine habitats. Some of the spills were of thick oil and have persisted longer in sheltered coastal habitats that were contaminated. In general, these shipwrecks have occurred on rocky coastlines, and the oil was washed away by storms and tides with no several-year effects on wetland-estuarine habitats.

Cumulative freight traffic (associated with mining and oil and gas facilities) in the Gulf of Alaska and in the Bering Sea and tour-boat traffic in the Gulf of Alaska are other potential sources of oil spills that would have similar effects on wetlands and estuaries as described above.

Offshore gold mining in State of Alaska waters in Norton Sound in adjacent waters affects wetland-estuarine habitats from turbidity associated with the dredging and deposition of bottom sediments in the mining areas. This turbidity has local effects on estuarine fish and invertebrates within the dredge plume that persist during the dredging season. Dredging also could result in the release of toxic trace metals into the water column, which would increase their bioavailability in the food chain. This might lead to reproductive effects on marine and coastal birds and health effects on humans who consume fish, marine mammals, and birds (see USDOI, MMS, 1991d).

The harvest of timber along the coast of Southeast Alaska has local alteration effects on the wetland-estuarine habitats. Clear cutting has increased soil erosion, water turbidity, and water temperature in adjacent streams flowing into estuaries and wetlands. These changes are assumed to harm the spawning habitat of anadromous fish in the streams and estuaries adjacent to logging sites. Such effects would persist for several years near logging sites.

Onshore oil development centered in the Prudhoe Bay-Kuparuk River area and in an adjacent offshore area and past exploration on the National Petroleum Reserve-Alaska (see Section IV.D.1.c, Environmental Impacts of Alternative I — Cumulative Case) has had local effects on wetlands and estuaries through alteration of coastal habitats. The construction of two causeways in the Prudhoe Bay area has had effects on the local hydrology (salinity and current patterns of adjacent coastal waters) that is believed to result in changes in the distribution and productivity of some anadromous- and marine-fish populations. The construction of offshore gravel islands for oil and gas exploration on State of Alaska and Federal OCS leases in the Beaufort Sea has had temporary (one season) turbidity effects on some adjacent estuary habitats during construction activities. Cumulative vessel-support traffic such as the sealift barges that deliver prefabricated oil facilities to the onshore oil fields, fuel barges associated with onshore and offshore oil facilities, and fuel supplies associated with drillships and other movable drill platforms are expected to result in some accidental oil spills sometime over the cumulative life of oil development in the Arctic. Numerous small onshore oil spills have been associated with the TAP. Oil contamination of (perhaps a few hundred kms) coastal wetlands from accidental fuel spills offshore are expected to affect the diversity and productivity of invertebrate communities sensitive to oil in wetland-estuarine habitats where the oil is retained in the soil and in the sediments. Such effects could persist for more than 10 years (see Section IV.A).

Oil development associated with Federal OCS leases from sales in the Beaufort Sea and sales in the Chukchi Sea as well as development associated with the proposed program and future programs would have additional oil-spill and habitat-alteration effects on wetland and estuary habitats in the Arctic (see Section IV.D.1.a(8), Impacts on Coastal Habitats). In the cumulative case, three platform spills, four pipeline spills, and seven tanker spills are assumed to occur in association with cumulative OCS exploration and development in the arctic and transportation of OCS Arctic oil. A total of 1,375 small spills of 1-50 bbl and 56 of 51-999 bbl are assumed to occur.

Oil-tanker traffic in and out of Prince William Sound and Cook Inlet is a major source of oil spills in the Gulf of Alaska. One or two sizable crude-oil spills believed to have come from the release of bilge waters from tankers occurred around 1970 in the Cook Inlet area and contaminated coastal habitats of Kodiak and Afognak Islands and the south side of the Alaska Peninsula. Another tanker spill occurred in Cook Inlet in 1988, 1 year before the *Exxon Valdez* oil spill in Prince William Sound. These oil spills have resulted in the cumulative contamination of coastal habitats in the western part of the Gulf of Alaska (particularly Kodiak and Afognak Islands and the southside of the Alaska Peninsula). However, no scientific investigations on the effects of the earlier spills prior to the *Exxon Valdez* spill have occurred. An estimated 5,300 km of shoreline including wetlands were oiled from the *Exxon Valdez* spill. The *Exxon Valdez* oil spill is expected to have long-term (more than 10 years) effects on some wetland-estuarine habitats where the oil persists in wetland-intertidal sediments.

Oil-tanker traffic assumed from proposed Federal lease sales in the Bering and Chukchi Seas and Gulf of Alaska would be an additional sources of oil spills in the Alaska Region. Twelve oil spills (1,000 bbl or greater) are assumed to occur from Federal OCS tanker traffic under the proposal. These spills could add to the contamination of (perhaps several hundred to one thousand kms) wetland-estuarine habitats in the Hope Basin, Bering Sea, Gulf of Alaska, and along the tanker routes to terminals in Washington and in California. These oil spills are expected to contaminate some (perhaps 20-30%) wetland-estuarine habitats along the tanker routes. Effects on the diversity and productivity of oil-sensitive invertebrate communities in contaminated wetlands are expected to persist for more than 10 years where the oil is retained in the wetland sediments (see Section IV.D.1.a(8)).

In summary, primary cumulative effects on wetland-estuarine habitats come from habitat alterations and oil spills. Activities associated with these effects include past construction of DEW Line Stations along the arctic coast, onshore mining in the Hope Basin area, and oil and gas exploration and development. Mining and Dew Line Station development`has had habitat-alteration effects at the coastal locations where industrial activity occurred. The construction and presence of causeways associated with oil development in the Arctic affect estuarine hydrology (salinity and current patterns) and may affect marine and anadromous fish. These effects are expected to last over the life of causeways. Oil spills associated with cumulative oil development in the Arctic, including small fuel-oil spills (such the estimated total number of small spills in the Arctic: 1,375 of 1-50 bbl and 56 of 51 to 999 bbl), pipeline spills (4), platform spills (3), and tanker spills (7), are expected to contaminate some wetland-estuarine habitats and have long-term, several year effects on the diversity and productivity of oil-sensitive invertebrate communities where the oil is retained in the sediments for several years.

Primary cumulative effects on wetlands and estuaries in the Bering Sea and in the Gulf of Alaska are associated oil spills from with commercial fishing, oil tankering (6 spills of 1,000 bbl or greater), other freight- and tour-vessel traffic, Federal and State of Alaska oil and gas exploration and development platforms in the Bering Sea and Gulf of Alaska, and offshore mining and timber activities (see Section IV.D.1.c). Shipwrecks associated with commercial fishing are a chronic source of oil spills in the Bering Sea. Most of these wrecks occur on rocky shorelines and have short-term effects due to the natural removal of the oil by wave and tide action; but some of the thicker fuel-oil spills can have long-term effects when wetlands are contaminated. Oil-tanker traffic in and out of Cook Inlet and Prince William Sound is a major source of oil spills in the Gulf of Alaska. Approximately 13 OCS and non-OCS spills are estimated to occur from tanker transportation from Valdez to terminals to the south (primarily in California). Six of these spills are assumed to come from OCS oil transported through TAP. Past spills have resulted in the cumulative contamination of coastal habitats in the western part of the Gulf of Alaska. The *Exxon Valdez* oil spill is expected to have long-term (more than 10 years) effects on some wetland-estuarine habitats where the oil persists in the wetland and intertidal sediments. An estimated 5,300 kms of shoreline including wetlands were oil by the spill. An additional source of oil-spill effects on wetland-estuarine habitats would result from assumed oil tankering associated with proposed lease sales in the Hope Basin and Bering Sea under the proposal. Freight-vessel traffic associated with mining and in support of oil and gas development in the Bering Sea and in the Gulf of Alaska and tour-boat traffic would be other sources of oil spills that might affect wetlands and estuaries. The cumulative 13 tanker spills would have similar effects on wetlands and estuaries as described above. These oil spills are assumed to contaminate some (perhaps 20% or several hundred to over a thousand kms) wetland-estuarine habitats along the tanker routes. Where the oil contacts sheltered wetland-estuarine habitats, the diversity and productivity of oil-sensitive invertebrate communities is expected to be reduced, with recovery taking more than 10 years.

Offshore gold mining in State of Alaska waters in Norton Sound and proposed Federal OCS mining in adjacent waters could have local water-turbidity effects on estuarine fish and invertebrates within the dredge plumes during mining operations. Dredging also could release toxic metals into the water column and could affect fish, marine birds, and human health. The timber harvest in southeast Alaska would have estuarine habitat effects adjacent to timber harvest sites through increased soil erosion, water turbidity, and increased water temperature that would harm spawning success of anadromous fish in streams and estuaries adjacent to logging sites. Such effects are expected to last for several years.

CONCLUSION: The overall cumulative effect of industrial activities on wetland-estuarine habitats in the Alaska Region would come from oil spills associated with oil development, commercial fishing, and oil-tanker and other vessel transportation. The cumulative effects of oil spills in the Alaska Region on species diversity and productivity of contaminated invertebrate communities in (perhaps several hundred to a thousand kms) wetland-estuarine habitats are expected to persist for more than 10 years due to the retention of the oil in the sediments and the slow recovery of sensitive invertebrate species. The proposal is estimated to contribute perhaps 20 percent of the oil spills and oil spill effects under the cumulative case. Cumulative habitat alteration in the Arctic, especially the construction and presence of causeways, is expected to alter the physical integrity or the hydrology (changes in salinity and current patterns) of (perhaps several hundred to a thousand kms) the wetland-estuarine habitats adjacent to the causeways with effects lasting for more than 10 years or over the life of the causeways. These effects are expected to alter the movements and distribution of anadromous fishes near the causeway sites. The proposal is estimated to contribute perhaps 10 to 20 percent of the cumulative causeway effect. Other industrial activities such as mining and timber cutting alter water chemistry (from mine spoil) and temperature (clear cutting adjacent to streams) in streams flowing into wetland-estuarine habitats. These effects are expected to persist for several years.

(c) Pacific Region

WETLANDS AND ESTUARIES: Factors that may produce cumulative effects on estuaries in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to estuaries in U.S. waters include increases in urban development, municipal and industrial discharges, and Alaskan and foreign-import tankering.

The loss of estuarine habitat, particularly in southern California has been staggering. According to Zedler (pers. commun.) 91 percent of the original estuarine habitat of southern California has been lost and even if all development were to stop today, the process of continued estuary loss, having been set in motion, will not stop. Many anthropogenic processes are involved in this loss, but the greatest cause is development involving filling in of estuaries so structures can be constructed. Although policies, such as the No Net Loss of Wetlands policy of the president, have been implemented, the continued loss of estuarine habitat by urban development can be assumed, although at a lower rate than in the past.

Next to development, domestic and industrial sewage may cause the greatest effect on estuaries. The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in section IV.D.1.c. Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986). Most of the estuarine habitat in Southern California has already been severely altered, much of it possibly beyond repair. An increase of 259 MGD (22%) of municipal wastewater discharges into southern California, including parts of the 87-tract area, between 1970 and 1985 suggest that some of the major problems affecting estuaries have not been remedied. Since the increase is expected to continue similarly during the foreseeable future, significant remediation appears unlikely. Although most of the wastewater does not flow directly into estuaries of the proposed sale area, wastewater affects estuaries directly as well as indirectly by having polluted water as part of the environment.

Due to the high degree of concern for estuaries, despite of or because of their slow demise, it is assumed the pipeline expected to go ashore from an existing lease will not cross an estuary.

Although most of the estuarine habitat in the 87 tract area and southern California, in general, has undergone extensive reduction, several estuaries, including Morro Bay, Santa Maria River, Santa Ynez River, Goleta Slough, Carpinteria Marsh, Mugu Lagoon, and further south, Anaheim Bay, Upper Newport Bay and Tijuana Estuary apparently remain relatively unaltered.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on benthic communities. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

Assuming a large oil spill entered an estuary and stayed several tidal cycles and penetrated into sediments, impacts would be severe as follows. The marsh and mudflat habitat would be the most sensitive to impact. Morro Bay (discussed more extensively in USDOI, MMS, 1983b), Goleta Slough, Mugu Lagoon, Anaheim Bay, Tijuana River and possibly San Diego Bay could experience the largest impacts in terms of marsh habitat. The dominant marsh plant *Spartina foliosa* would experience extensive mortality of thousands of individuals if oil were to penetrate into the sediment around the root system. A significant interference with ecological relationships lasting at least five years would occur involving a myriad of plant and invertebrate associates either through direct mortality or indirectly through the absence of the community dominant. Pickleweed *Salicornia* spp could experience a similar impact although, since it occurs at a higher tidal level, may not be as likely to be contacted by oil.

Conversely, oil from a spill can become stranded at high tide level when the tide lowers. This could expose pickleweed to oil for longer periods. Evidence from the 1988 Shell Oil refinery oil spill in San Francisco Bay, however, suggests that pickleweed was impacted primarily from cropping oiled plants as a process of cleanup rather than from mortality from the oil (Fischel and Robilliard, 1991).

In terms of mudflat habitat, estuaries subject to the most extensive impacts are Morro Bay, Mugu Lagoon and San Diego Bay. As with the salt marsh habitat, extensive penetration of oil into the mud sediment, where it could remain for years (probably over 10), would cause extensive impacts to the many infaunal invertebrates of the habitat. Certain susceptible species could experience such high mortality that they could become endangered or, unless restocked from other estuaries, eliminated in the impacted estuary. These impacts would also occur under the same conditions in the Pacific northwest or other parts of California. Although all 17 spills may contact shore, it is not logical to assume that all spills will enter an estuary. Less than half would be assumed to enter estuaries along the entire Pacific Region. The severe impacts described above for estuaries will not change the function of estuaries regionally in Washington, Oregon or northern and central California, since the number of estuaries which would be impacted relative to the large number of estuaries present minimizes the possibility of measuring any real alteration of estuarine function within the region. Due to the scarcity of relatively pristine estuaries in southern California, however, spills entering any of these estuaries would cause community functional alterations lasting over 10 years to a rare resource. However, due to seasonal closure, narrow openings and large distances separating the relatively unaltered estuaries, only half are expected to be entered by oil spills. Estuaries in southern California could be dysfunctional for up to 10 years, virtually eliminating relatively healthy estuaries in the region for this period.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the spills 1,000 bbl or greater discussed above. In the unlikely event a small spill actually enters an estuary, at worst, a few individuals of the more sensitive species may be lost, but there would be no interference with ecological relationships.

In summary, loss of an already depleted estuarine habitat (91%) in the area of the proposal from filling, construction and sewage, particularly in municipal areas is expected to continue, although at a reduced rate. Impacts from routine OCS activities are not expected. Oil spills are assumed to enter estuaries in both southern California and northern Washington. Impacts of oil spill entering an estuary and remaining for several tidal cycles, will involve destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require 5 to 10 years. Approximately half of the relatively unaltered estuaries within the SCB are expected to be entered, virtually eliminating half of the relatively healthy estuaries in the region for up to 10 years. Regional impacts could involve a decrease of several population in local estuarine communities, but with no real interference with ecological relationships in the region.

CONCLUSION: Estuarine habitat will continue to decrease in the Pacific Region, particularly in the populated areas of California, for the next 35 years. The primary cause of the decline will continue to be from urban development and, to a lesser extent domestic and industrial pollution. For the most part, impacts from the assumed spills will not be discernible from normal community population fluctuations within the Pacific Region. In southern California, where relatively unaltered estuaries are rare, contact by an oil spill could destroy major components of the affected estuarine community for up to 10 years.

(d) Atlantic Region

1) Wetlands and Estuaries

The existing conditions of the Atlantic estuaries and wetlands are described in Section III.D.2.e. The quality and health of these environments has been stressed by a variety of natural and human causes. The major natural cause of wetlands loss or stress has been sea level rise. Human-created stresses have ranged from hydrocarbon and non-hydrocarbon (pesticides, fertilizers, sewage, etc.) pollution to drainage for mosquito control and development projects, and dredging of ship channels. Some of the impacts on estuaries and wetlands have both natural and human sources. Sediment loading is basically a natural phenomenon that has been greatly increased by agricultural practices, storm drainage systems, and development activities. The cumulative and high-case scenarios are similar as described in Section IV.D.1.b(8). However, in this scenario, the infrastructure is assumed to be supported by natural gas production. With the low probability of an oil spill (1,000 bbl or greater) from producing 90 MMbbl of oil (15 percent), it is assumed that an oil spill will not occur and contact estuaries and wetlands in this scenario. Routine activities assumed for this scenario that could potentially cause impacts to estuaries and wetlands are onshore support base activity and the construction of four pipelines and three gas processing plants. Because of existing regulations, it is assumed that the gas processing plants will not be constructed in estuarine or wetland environments. Accidents that are assumed to occur from these activities which could affect these environments are small spills, most of which are expected to occur offshore.

A major source of pollution of the estuarine and wetland environments is from non-hydrocarbon chemicals. These chemicals have resulted in chronic and long-term impacts. Acid rain falling on the upper reaches of Atlantic estuaries has been implicated in the decline in striped bass population. Nutrient input from point sources (e.g., sewage outfalls) and non-point sources (e.g., urban and agricultural runoff), have caused anoxic conditions in some deepwater estuarine areas making them uninhabitable for aquatic life. Eutrophication has also resulted in killing sea grasses, thus reducing the habitat for the larvae of many fish and shellfish species. Some of the changes that have been noted in estuaries along the Atlantic coast are declines in fish productivity, anoxia-related fish kills, increases in fish diseases, changes in the distribution of aquatic sessile organisms, impairment of nursery functions, eutrophication (i.e., increased nutrient levels and decreased oxygen levels), and habitat loss (Holman, 1989). Closures of specific shellfish areas have been invoked because of pollutant levels (Holman, 1989). Passage of a series of amendments and new laws since 1970 have served to reverse the trend of pollutants reaching the estuarine areas along the coast; however, pollutant levels for most toxic substances have not yet dropped to levels measured in the early 1900's. With the difficulty in controlling non-point source pollution, it is expected that estuarine and wetland areas will continue to be affected by various pollutants. This will be especially true in highly urbanized areas and areas with extensive agricultural activities. It is expected that Delaware Bay will continue to experience high levels of fertilizer input from the drainage of farm lands which cover approximately 50 percent of the Delaware drainage basin. No OCS impacts are expected for Delaware Bay. In addition to being degraded by pollution, wetlands are continually being lost from draining, dredging, and filling to enable development of private and recreational facilities. Impacts from these activities can be very high in localized areas and are mostly irreversible. Additionally, much wetland area is lost to natural processes such as sea-level rise, subsidence, compaction, and wave action along with resultant coastal erosion. Historic wetland loss has been the greatest in the States of North Carolina and Florida. These two states account for 46 percent of the Atlantic wetlands and 60 percent of the Atlantic wetland loss. Total wetland loss from the 1780's to the 1980's for the Atlantic coastal States has been 24,394,275 acres. This has been a 40 percent reduction in approximately 100 years (Dahl, 1990).

Pipeline construction for OCS production would contribute to temporary wetland loss. However, with proper construction and reclamation procedures this loss can be minimal and reversible. Tanker transportation of crude and refined oil and OCS oil production account for less than half of the oil in the marine environment (NRC, 1985a). Over 50 percent of the oil in the marine environment comes from municipal and industrial wastes and river runoff. Based on the level of foreign imports over the next 30 years, it is assumed that there will be four large tanker spills in Delaware Bay. None of these would be attributable to OCS activities.

Impacts under this scenario on estuaries and wetlands of the Atlantic States varies widely. Many areas experience no impacts while other areas are experiencing long-term, chronic impacts. The production of offshore natural gas could possibly reduce impacts on coastal resources by reducing the amount of oil brought to the area by tanker. By replacing some of the oil with natural gas as an energy source, the chance of a major oil spill would be reduced. The amount of impact reduction, if any, can not be quantified at this time. In spite of efforts to reduce pollution entering estuaries and wetlands along the Atlantic coast, it is expected that many of these environments will continue to be degraded. OCS activities are not expected to have a measurable effect on the conditions of the Atlantic estuaries and wetlands. As noted in the impact analysis for the proposed action, these impacts will occur only at pipeline landfall locations in the South Atlantic Bight, with complete recovery of the habitat achieved within two years.

CONCLUSION: Cumulative activities are expected to cause chronic impacts on estuaries and wetlands along the Atlantic Coast with effects in localized areas lasting more than 10 years. Large spills from foreign imports are expected to affect Delaware Bay; recovery will take from 2 to 10 years. OCS activities are not expected to contribute measurably to these impacts.

2) Shorelines

The existing conditions of the Atlantic shorelines are described in Section III.D.2.e. As is the case with estuaries and wetlands, shorelines have been affected by a variety of natural and human causes. The major causes of shoreline impact has been sea level rise and the attempts by man to control the resulting retreat of the shoreline. Methods used to control the erosion of the shoreline fall into two categories, shoreline hardening (construction of groins, jetties, seawalls, etc.) and beach nourishment (from offshore or onshore sand/gravel supplies). Presently, over 80 percent of the Atlantic coast is experiencing moderate to severe erosion. Development activities have destroyed some of the sand dunes and other features of the Atlantic coast which normally help prevent erosion. The net result of these activities is expected to be the permanent alteration of over 80 percent of the coastline. In contrast to these activities, the only expected impact to shorelines from routine OCS activities is the temporary destruction of a 15 m (50 ft) swath across the beach from pipelaying activities at 4 separate locations. Habitat recovery at these locations is expected to be complete in 2 to 3 years.

Accidents that can affect shorelines are assumed to be 12 large oil spills in the Mid-Atlantic Bight and 1 large oil spill in the South Atlantic Bight resulting from existing import tanker traffic. It is assumed that at least one of these spills will contact land near the mouth of Delaware Bay. The production of OCS resources is not assumed to result in a large oil spill. While a small spill is assumed to occur at each support base from OCS activities, these spills are not expected to measurably affect shorelines. Impacts on shorelines from the large (non-OCS) spills are expected to be mainly aesthetic. Disruption of the sand budget from the removal of oiled sand can cause erosion in the vicinity of the spill contact; beach replenishment would limit erosional problems to one or two years.

CONCLUSION: Permanent alteration of over 80 percent of the Atlantic shoreline is expected to occur. This alteration will be due mainly to erosion from rising sea level and man's efforts to control this erosion. OCS activities will not contribute measurably to this impact.

(9) Impacts on Seafloor Habitats

(a) Gulf of Mexico Region

1) Chemosynthetic Communities

Cumulative factors considered to impact the deep-water benthic communities (e.g., chemosynthetic communities) of the Gulf of Mexico includes both oil- and gas-related and non-oil- and gas-related activities.

Non-oil- and gas-related activities which might adversely impact these communities include bottom fishing, trawling, and anchoring. However, fishing and trawling in the deeper waters of the Gulf of Mexico are minimal and impacts are expected to be negligible. This analysis considers the effects of these factors related to the proposed action, prior and future OCS sales.

The oil- and gas-related impact-producing factor (as in the base case) is the physical disturbance of the bottom where these communities are found by such activities as pipelaying, anchoring, and structure emplacement, as well as a seafloor blowout. These activities cause localized bottom disturbances and disruption of benthic communities in the immediate area of the drilling. No other impact-producing factors from oil and gas activities are expected to present a threat to these deep-water communities. While the opportunities for impact are somewhat higher for this cumulative case than for the proposed action, NTL 88-11 will still be effective in detecting the high-density communities and providing for their avoidance by oil and gas activities. Section IV.D.1.a(9) contains a more detailed description of the impact-producing factors affecting the chemosynthetic communities. As noted under the base case, it is highly unlikely that routine discharges or accidental oil spills from the proposed activities would adversely impact the benthos in the water depths (greater than 400 m) being discussed, due to the rapid dilution and dispersion of effluent components.

As noted in the base case, the greatest potential for adverse impacts to occur to the deep-water benthos stems from pipeline and platform emplacement and associated anchoring activities. The impacts to benthos from these activities are discussed above. As exploration and development continue on the Federal OCS, activities in the Gulf of Mexico have moved into the deeper water. With this trend comes the certainty that increased development will occur in these areas, accompanied by the potential for increased stress to the deep-water benthos from bottom disturbances and disruption of the seafloor from associated activities. The extent of this disturbance will be determined by the intensity of development in these deep-water regions, as well as the types of structures and mooring systems utilized. For instance, it is assumed that 12,050 exploration and delineation wells and 7,780 development wells will be drilled, and that 518 platforms will be installed. However, as noted above, Notice to Lessees 88-11 operates to protect high-density chemosynthetic communities in a high percentage of the cases (but not 100% of the time); for purposes of this analysis, the frequency of impact from bottom disturbance is considered to be once every six months to two years, but the severity of impact is such that the loss of elements and/or relationships will not occur.

A blowout at the seafloor could resuspend large quantities of bottom sediments and even create a large crater, destroying any organisms in the area. Fortunately, blowouts are rare in the Gulf (seven for every 1,000 wells drilled) and so are not expected to pose a significant threat to these communities.

In summary, the only impact-producing factor threatening the chemosynthetic communities is physical disturbance of the bottom, which would destroy the organisms comprising these communities. Only structure emplacement is considered to be a threat, and then only to the high-density (Bush Hill-type) communities; the widely distributed low-density communities would not be at risk. The provisions of NTL 88-11 (currently in effect), requiring surveys and avoidance prior to drilling, will reduce, but not completely eliminate, the risk.

Activities not related to the OCS oil and gas program include fishing, trawling, and anchoring. Because of the depths of the water in these areas, these activities are not expected to have any impact on the chemosynthetic communities.

CONCLUSION: The activities associated with the proposed action are expected to cause little damage to the physical integrity, species diversity, or biological productivity of the wide-spread low-density chemosynthetic communities, with recovery from any damage to pre-impact conditions expected to take less than two years. The activities associated with the proposed action are expected to cause little damage to the physical integrity, species diversity, or biological productivity of the rarer, widely scattered high-density Bush Hill-type chemosynthetic communities, with recovery from any damage to pre-impact conditions expected to take less than two years. Activities not associated with the proposed action are not expected to have any impact on chemosynthetic communities.

2) Topographic Features

Oil and gas leasing has been increasing around the topographic features of the Gulf of Mexico, and this trend is expected to continue in the future. Of the 367 blocks in the Gulf of Mexico that are near the topographic features, 229 are under active lease (as of January 30, 1991). Many oil and gas operations on the previously leased blocks are subject to the provisions of a biological stipulation, as will leases resulting from this proposal. These operations are not expected to have an adverse impact on the biota of the topographic features. Thus, the impact from cumulative oil and gas routine operations would be limited to those impacts from operations conducted as a result of any future OCS sales held after the sales proposed by this program but without benefit of the stipulation; such impacts are estimated to be very severe. The impacts from oil and gas routine operations in the cumulative case include those from the operations conducted as a result of the proposed action (Section IV.D.1.a(9)), future OCS sales, past sales, hurricanes, the activities of scuba divers, the collapse of the tops of the features due to dissolution of the underlying salt structure, ocean dumping, and the tankering of imported oil.

Anchor damage and damage from structure emplacement are considered to be the most serious threats to coral and coral-community areas (Bright and Rezak, 1978; Rezak and Bright, 1981). The biological stipulation on the existing leases and leases resulting from this proposal prohibits the anchoring of industry-related vessels and the emplacement of structures by the industry in the No Activity Zones; the stipulation does not affect other activities such as anchoring, fishing, or recreational scuba diving. No data are available on the extent to which such anchoring may take place; however, all three activities are known to occur in proximity to the topographic features. Nearly all the banks are near established shipping fairways. The banks are apparently well-known fishing areas. Several of the shallower cresting banks are scuba trip destinations. Anchoring at a topographic feature by a vessel involved in any of these activities would cause significant damage to the biota, and although the degree of damage would depend on the size of the anchor and chain, there is the potential for serious anchor damage to the biota of the topographic features. Treasure hunters have destroyed large areas of Bright Bank by using explosives to blast through the coral reef. The impact has been high to Bright Bank as a result of this blasting activity; however, such blasting is not a common event. All of the impacts described above for the base case would also pertain in this case. Thus, for the purpose of this analysis, the frequency of these events is judged to be once or twice each year, and the severity of the impact is considered to be such that there are no changes to physical integrity, species diversity, or biological productivity. Recovery of the system to pre-interference conditions will take less than two years.

Impacts to the topographic features could occur as a result of operational discharges from import and shuttle tankers. Due to the dilution factor and the depths of the banks, this activity is expected to have little impact on the topographic features. This is also true for the very low level of ocean dumping that occurs in the Gulf (and which is being phased out).

Impacts from natural occurrences such as hurricanes are not expected to result in damage to the biota of the banks. Collapse of the crest of the banks from dissolution of the underlying salt structure is possible, but unlikely and certainly uncontrollable by human activity. Scuba divers may visit the shallow banks, and their collecting activities may have an adverse impact on the biota of those banks. Other than anchor damage, however, such activities are not expected to have major impacts on the banks.

Some 138.46 million bbl of drilling muds and 33.44 million bbl of drill cuttings are estimated to result from drilling activities associated with the cumulative OCS activities. Drilling muds and cuttings are routinely discharged into offshore waters and are regulated by NPDES permits. As noted above under the base case, most water-based fluids are relatively nontoxic (and the more toxic effluents are not allowed to be discharged under the NPDES permit), and their effects are limited to the immediate vicinity of the discharge (NAS, 1983). No effects to the biota of the topographic features are expected due to toxicity. Small amounts of drilling effluent may reach a bank from wells drilled more than 1,000 m away; however, these amounts from single wells, where measurable, would be extremely small and would have no effect on the biota. Effluents discharged at the water's surface within 1,000 m of a bank could impact the biota of the bank, although the currents at the banks would tend to keep the bank swept clean of fine sediments and would prevent the accumulation of drilling muds at the bank. The muds and cuttings can smother the sessile benthic invertebrates causing mortality. Turbidity from the discharge can cause reduced light levels to the benthic organisms and clogging of the feeding mechanisms of the sessile invertebrates. These conditions can lead to reduced productivity, susceptibility to infection, and mortality.

Up to 15.7 billion bbl of produced waters are estimated to result from cumulative OCS activities, 12.56 billion bbl of which will be discharged offshore. Only a small fraction of this would be in the vicinity of the topographic features. As indicated in the base case, produced waters contain high concentrations of inorganic salts ranging from a few milligrams per liter (mg/l) to 350,000 mg/l. Hydrocarbons and organic compounds may be present in parts per million (ppm) levels (Offshore Operators Committee, 1975). As indicated by the Buccaneer Oil Field Study (USDOC, NMFS, 1977), near-platform macrobenthic populations were depressed and had a high turnover rate as compared to the surrounding sea bottom; this may have been a result of increased scour action around the platform structure itself, but no cause-effect relationship was established. However, the protection discussed (Section IV.D.1.a) will preclude these activities in the No Activity Zone and will require shunting of these discharges in zones around the high relief banks, thus minimizing adverse effects from this factor.

In order to mitigate the impacts of these discharges to the biota of the topographic features, the MMS, as a condition of the operational plan approval, can require the operator of a lease to perform certain measures, such as shunting, that would reduce the impacts. The USEPA, through its NPDES permitting procedures, may also require mitigative measures. Current leases and leases resulting from this proposal near topographic features contain a biological stipulation that protects the biota of the bank from most impacts from oil and gas operations, but leases resulting from future leases after this proposal may not contain this restriction. However, most of the blocks near the topographic features are currently leased, and it is likely that even more of them will be leased, with the stipulation as a part of the leases, by the end of this proposal. Thus, for the purpose of this analysis, the frequency of these events is judged to be once or twice each year, and the severity of the impact is considered to be such that there are no changes to physical integrity, species diversity, or biological productivity. Recovery of the system to pre-interference conditions will take less than two years.

Many platforms could be removed during the life of this proposal; some may be near topographic features. However, the Topographic-features Stipulation, which has been applied in the past to all leases on or near such features, and will be applied to leases resulting from this proposal, prevents the installation of platforms in the near vicinity of the biota of concern, thus reducing the potential for impact from this factor. Thus, the impact from this factor is negligible. See Section IV.A for more information regarding structure removals.

It is assumed that under the cumulative scenario, 10 oil spills greater than or equal to 1,000 bbl would occur from program-related activities Gulfwide. Further, it is assumed that 37 oil spills (greater than 50 bbl and less than 1,000 bbl) would occur, and 985 spills (greater than 1 bbl and less than or equal to 50 bbl) would occur, due to activities consider under this cumulative scenario. An estimated 63 spills (average size of 30,000 bbl) will occur from import tankering of foreign and domestic crude into the Gulf of Mexico. Of these, 11 are estimated to occur in open waters. Up to 169 petroleum product spills (11,000 bbl in size will occur Gulfwide, with 29 of these estimated to occur in open waters. Because of the water depths in which topographic features are found, no oil from oil spills from any source will reach the biota of concern. As discussed for the base case, blowouts are rare in the Gulf (seven for every 1,000 wells drilled) and, even if one occurred, it is unlikely that any oil spilled into the water column from a blowout would reach the biota of a topographic feature. Therefore, it is assumed that no spills of any size will contact the biota of the topographic features.

In summary, non-OCS oil and gas activities are judged to have little, if any, impact on the biota of the topographic features (except for anchoring, described in detail above). These include hurricanes, activities of scuba divers, the collapse of the tops of the banks, ocean dumping, and the tankering of imported oil.

Those OCS oil and gas program-related activities posing the greatest threat to the biotic communities of the banks include anchoring of vessels and structure emplacement, operational discharges (drilling muds and cuttings, produced waters), blowouts, oil spills, and structure removal. As indicated in the base case, those activities that cause physical disturbance to the bottom of the topographic features, and present the greatest threat to the biotic communities of the banks, will be prevented by the imposition of protection equal to that provided by past Topographic Features Stipulations (No Activity Zones, etc.).

It follows from the above that, as with the base case, activities resulting from this proposal, especially bottom-disturbing activities, have a potential for causing minor impacts to the biota of the topographic features. However, those activities having the greatest impacts are also those most likely to occur.

CONCLUSION: The activities associated with the cumulative scenario are expected to cause little damage to the physical integrity, species diversity, or biological productivity of the habitats of the topographic features of the Gulf of Mexico, with recovery from any damage to pre-impact conditions expected to take less than two years. The activities associated with the proposed action are expected to cause little to no damage to the physical integrity, species diversity, or biological productivity of the habitats of the topographic features of the Gulf of Mexico. Small areas of 5-10 m^2 would be impacted, and recovery from this damage to pre-impact conditions is expected to take less than 2 years, probably on the order of 2-4 weeks.

3) Live Bottoms

This cumulative analysis considers the effects of impact-producing factors related to the proposed action plus those related to prior and future OCS sales, tanker and other shipping operations that may occur and adversely affect live bottoms associated with the pinnacle-trend area. Specific types of impact-producing factors considered in the analysis include drilling rig, platform, and pipeline emplacement; well drilling (discharges); hydrocarbon production (produced waters); blowouts; oil spillage; anchoring; and operational discharges by tank ships. Non-OCS-related impacts, including fishing pressure, natural events, increased anchoring from pleasure boats, and spillage from import tankering, have the potential to impact the pinnacle communities.

It is assumed that biological stipulations or comparable mitigation will be made a part of appropriate leases resulting from this proposal. The stipulations force the operators to locate the individual pinnacles and associated communities that may be present in the block. This will help to protect those regions which may be potentially impacted by OCS activities and, if so, require any appropriate mitigative measures. The biological stipulations do not affect or protect the resources from activities over which the MMS has no authority (i.e. commercial fishing, tanker and shipping operations, or recreational activities).

Non-OCS activities have the greatest potential to affect the hard-bottom communities of the region. Recreational boating and fishing, import tankering, and natural events (such as storm and hypoxic conditions) may lead to damage, and is a serious threat to the hard-bottom communities. The area of the pinnacle trend is located near a major shipping fairway, and ships using this fairway into Mobile, Alabama, can be expected to anchor in this area on occasion. Numerous fishermen also take advantage of the relatively shallow and easily accessible resources of the region and are expected to anchor in these areas to fish. It is estimated that several instances of severe and permanent mechanical damage to the pinnacles and the low-relief live-bottoms are likely to occur as the result of the cumulative scenario. It is projected that this damage to one or more components of a few regionally common habitats or communities results in changes to physical integrity, species diversity, or biological productivity that exceeds natural variability observed prior to the damage, and recovery to pre-impact conditions takes longer than 10 years.

The placement of drilling rigs, platforms, and anchors on the seafloor crush the organisms directly beneath the legs or mat used to support the structure. The areas affected by the placement of the platforms and rigs will predominantly be soft-bottom regions where the infaunal and epifaunal communities are not unique. The presence of a conventional structure (some 368 platforms are expected to be constructed in the central and northeastern Gulf) can cause scouring of the surficial sediments (Caillouet et al., 1981). Also, it has been estimated that between 0.4 and 1.6 ha (1 and 4 ac) of bottom may be disturbed by platform emplacement activities alone. Structure placement and anchor damage from support boats and ships, floating drilling units, and pipeline-laying vessels disturbs areas of the seafloor and is the most serious threat to live-bottom areas at these depths. The size of the areas affected by chains will depend on depth of water, length of chain, size of anchor and chain, method of placement, wind, and current. The biological stipulations limit the proximity of new activities in the hard bottom region. For this reason, the damage from support boats and ships would be minimal. The impact from rigs and associated anchors on the hard bottom communities of the region as a result of the proposed action would be such that any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 2-8 weeks.

Both explosive and nonexplosive structure-removal operations disturb the seafloor and can potentially affect nearby hard bottom communities. Structure removal using explosives (the most common removal method) can suspend sediments which settle much in the same manner as discussed for muds and cuttings discharges. Charges used in OCS structure removals are typically 50 lb or less, and detonated five meters below the mudline. This serves to restrict the impacts to very close to the structure being removed (USDOI, MMS, 1987f). As previously discussed, the platforms will not be constructed directly on the hard bottoms because of the biological stipulation. Impacts to the hard bottom area from structure removal are expected to be minimal because of the restricted regions affected by the shock from explosives, and the low number of structures likely to be placed (and subsequently removed) in such regions. The impact of a structure removal would be such that it would not result in any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 4-8 weeks.

Drilling discharges affect biological communities and organisms through a variety of mechanisms. Smothering of organisms through deposition of these sediments may occur, or less obvious sublethal effects may take place. Oil and gas operations will routinely discharge drilling muds and cuttings, (some 138.46 million bbl of drilling muds and 33.44 million bbl of drill cuttings are estimated to be discharged as a result of all OCS activities). Up to 15.7 billion bbl of produced waters are estimated to result from cumulative OCS activities, 12.56 billion bbl of which will be discharged offshore.

Deposition of drilling muds and cuttings on the hard bottom communities would not significantly impact the biota of the hard bottoms or the habitat itself. The biota of the seafloor surrounding the hard bottoms are adapted to life in turbid conditions and existing currents in the regions would prevent the adverse accumulation of large amounts of muds and cuttings. The depth of water would dilute the effluent to a significant degree, and the hard bottoms themselves are coated with a veneer of sediment. Additional deposition and turbidity caused by a nearby well are not expected to significantly affect the hard bottom environment, since such fluids are discharged into very large volumes of water (the open Gulf of Mexico) and rapidly disperse, can be measured above background at only very short distances from the discharge point, and have little biological effect except very close to the discharge point. Such an event would rarely impact the resource because of the depth of the communities. The impact from muds and cuttings discharged as a result of the proposed action would be such that any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 2-8 weeks.

Pipeline emplacement will resuspend sediments and may clog filter-feeding mechanisms and gills of fishes and sedentary invertebrates. The stipulation, or some similar protective measure, will severely limit oil and gas activities in the immediate vicinity of the hard bottom communities. For the purposes of this analysis, it is presumed that pipeline-laying activities would be prohibited in the proximity of live-bottom communities. The effect of pipeline-laying activities on the biota of the hard bottom communities would be restricted to the resuspension of sediments. It is likely that pipelines up to 3,685 km (3,690 mi) of pipelines are expected to be installed under the cumulative scenario in the northern and northeastern Gulf. Enforcement of the biological stipulations minimize pipeline-laying activities through the hard bottom region. The severity of these actions has been judged, at the community level, to be such that any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 2-8 weeks.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)). That description includes assumptions of oil spill occurrence, spill sizes, and likely contacts with shoreline and wetlands areas.

Oil spills have the potential to be driven into the water column, with measurable amounts documented at depths approximating 10 m. At this depth, the oil is only found at concentrations several orders of magnitude lower than the amount shown to have an effect on marine organisms (Lange, 1985; McAuliffe et al., 1975 and 1981). In spite of the large number of surface spills, for the purpose of this analysis, it is projected that no surface spills, regardless of size, would have an impact on the biota of the hard bottoms. This is largely due to these features depth greater than 10 m. No impact from surface oil spills on the communities are expected.

It is assumed that one pipeline spill will occur in the northeastern Gulf of Mexico off Florida and four 25,000 bbl pipeline spills will occur off Louisiana/Mississippi a result of the cumulative scenario. Two of these pipeline spills are assumed to occur in the general vicinity of the hard-bottom region. These subsurface spills would have to come into contact with a pinnacle feature or low-relief live bottom for an impact to be observed. Few pipelines exist within these regions from which a spill would occur, and the biological stipulations would prevent the construction of pipelines immediately adjacent to these features.

There have been only 31 oil spills from pipelines on the OCS, 23 of which were between 50 and 1,000 bbl and only 8 more than 1,000 bbl (USDOI, MMS, 1988g). Any spilled oil would have to impinge directly upon the features to be detrimental to the communities; impacts, including uptake of hydrocarbons or reduced visibility, may then be serious to the local biota, even fatal. However, most of the region is washed in strong currents, and exposure to such an event would be short-term (3 to 96 hours). The biota would survive and recover once the features were clear of the oil.

There is a likelihood of the assumed pipeline spill contacting a hard-bottom community. However, for the purpose of this analysis, it is assumed that a spill greater than or equal to 1,000 bbl (regardless of the source) would contact one community. The above-listed factors would serve to limit the extent of damage from the spill. The severity of the contact would be such that any changes in the regional physical integrity, species diversity, or biological productivity of the pinnacle region would recover to pre-impact conditions in less than two years, more probably on the order of 2-8 weeks. The widespread nature of the resource, the strong dominant currents of the region, and the probable random occurrence of the pipeline spill, will serve to limit the effect of any pipeline spill on the hard-bottom communities.

Blowouts have the potential of resuspending sediment and releasing hydrocarbons into the water column which may affect benthic communities. Subsurface blowouts can pose a threat to the biota of these communities if a blowout were to occur near one of these habitats. From 1956 to 1989, 157 blowouts occurred on the OCS, only 28 of which resulted in the release of oil into the environment. Of these, 16 involved less than one barrel of oil spilled; only two blowouts resulted in the spillage of more than 6,000 bbl (USDOI, MMS, 1988g). It is assumed that 7 blowouts will occur for every 1,000 wells drilled, or approximately 30 blowouts across the northcentral region as a result of the cumulative scenario. Blowouts are not expected to be a significant threat to these communities because of the protective distances imposed by the biological stipulations. The frequency of subsurface blowouts impacting the resource is judged to be rare, and it is expected that any effects would be small in area. The biological stipulations prevent the drilling of wells close to biologically lush communities, thus preventing most adverse impacts from this factor. Blowouts outside this zone are unlikely to have an impact on the biota of the region because of the distances and strong currents. The severity of the contact would be such that any changes in the regional physical integrity, species diversity, or biological productivity of the pinnacle region would recover to pre-impact conditions in less than two years, more probably on the order of 2-4 months.

The impact analysis presented above presumes implementation of a biological stipulation, or some comparable mitigation, in the vicinity of the biologically productive hard-bottom communities. Should that protection not be provided, adverse impacts resulting from the proposed action, particularly anchor damage to localized hard bottom areas, are expected to have adverse impacts on some individuals at portions of the hard bottom trend environment, since these activities have the potential to destroy some of the biological communities and damage one or several individual hard bottoms. The most potentially damaging of these are the impacts associated with mechanical damages that may result from anchors. However, the action is judged to be infrequent because of the limited operations in the vicinity of the hard bottoms and the small size of many of the features. Potential impacts from large oil spills, blowouts, pipeline emplacement, muds and cuttings discharges, and structure removals exist. The proposed action, without the benefit of the biological stipulation, is expected to have an adverse impact on the hard bottom region.

In summary, non-OCS activities in the vicinity of the hard-bottom communities include recreational boating and fishing, import tankering, and natural events (such as storm and hypoxic conditions). These may lead to serious damage, and represent serious threats to the hard-bottom communities. Ships using the fairway into Mobile, Alabama, can be expected to anchor in this area on occasion, and the numerous fishermen take advantage of the relatively shallow and easily accessible resources of the region. These activities are expected to lead to several instances of severe and permanent mechanical damage. It is projected that this damage to one or more components of a few regionally common habitats or communities results in changes to physical integrity, species diversity, or biological productivity that exceeds natural variability observed prior to the damage, and recovery to pre-impact conditions takes longer than 10 years.

Impact-producing factors resulting from routine activities of oil and gas operations include mechanical damage caused by underwater oil spills, blowouts, anchoring, structure emplacement and removal, drilling discharges, and pipeline emplacement. These activities may threaten the sessile and pelagic communities associated with the crest and flanks of the hard bottom and low-relief hard-bottom features of the hard bottom region. Because protection similar to that of the biological stipulations are assumed to be attached to leases issued as a result of this proposal, the effects from these factors will have been mitigated on the biota of the banks. The potential impacts from spilled oil include uptake of hydrocarbons and reduced visibility; these impacts may be serious or fatal to the local biota. A blowout within a 100 m of a hard bottom community could result in the smothering of the biota within a very limited area of a hard bottom due to sedimentation. The placement of drilling rigs, platforms, and anchors on the seafloor will crush the organisms directly beneath the legs or mat used to support the structure. Structure placement and anchor damage from support boats and ships, floating drilling units, and pipeline-laying vessels disturbs areas of the seafloor and is the most serious threat to live-bottom areas at these depths. Structure removal using explosives (the most common removal method) could suspend sediments throughout the water column to the surface and may cause substantial impacts to nearby habitats. Deposition of these sediments would occur largely within the first 100 m of the site. Explosive structure removals create shock waves, which could also harm resident biota in the immediate vicinity. Smothering of organisms through deposition of drilling discharges (drill muds and cuttings) may occur; less obvious sublethal effects may also take place. Pipeline emplacement directly affects the benthic communities through burial and disruption of the benthos, and through resuspension of sediments. These resuspended sediments may clog filter-feeding mechanisms and gills of fishes and sedentary invertebrates. The majority of these impacts are mitigated through implementation of the biological stipulations or comparable measures. Because protection similar to that of the biological stipulations are assumed to be attached to leases issued as a result of this proposal, the effects from these factors will have been mitigated on the biota of the banks.

CONCLUSION: The impact under the cumulative scenario on the hard bottom communities of the northern Gulf region is expected to be such that this damage to one or more components of a few regionally common habitats or communities results in changes to physical integrity, species diversity, or biological productivity that exceeds natural variability (observed prior to the damage); recovery to pre-impact conditions is expected to take longer than 10 years. Recreational boating and fishing, import tanker activities, and natural events are expected to be the principal cause of these impacts. Impacts associated with the proposed program are expected to be negligible.

(b) Alaska Region

STEFANSSON SOUND BOULDER PATCH: The primary cumulative effects on the Boulder Patch communities are expected to come from potential oil spills from an offshore pipeline in Stefansson Sound and from the existing onshore pipeline (Sagavanirktok River-Endicott pipeline route) associated with oil development along the coast of the Beaufort Sea and from increased water turbidity and sedimentation associated with the burial of an offshore pipeline and construction of gravel islands and causeways in Stefansson Sound.

The existing State of Alaska Endicott oil-field development located about 2 miles from shore in Stefansson Sound includes an 80 acre main production island and 16.5 acre satellite drilling island connected to a 3 mile causeway running about parallel to the coast and connected to the Sagavanirktok River Delta by a 1.4 mile extension. This development is located shoreward of the Boulder Patch benthic communities. The potential turbidity and sedimentation effects on the Boulder Patch habitat from the construction of the Endicott production islands and causeway were monitored during the building of these structures. Scientific studies indicated that the turbidity plumes from the Endicott project had no serious or lasting effects on the productivity or growth of the Boulder Patch benthic communities during the construction period or after the causeway was built. However, the Endicott production platforms and causeway are more than one to several miles shoreward of the Boulder Patch habitat.

The onshore pipeline that connects the Endicott oil field with the TAPS pipeline crosses several of the Sagavanirktok River tributaries. A potential pipeline oil spill along the route is likely to spill oil into the Sagavanirktok River. If such a spill occurred during spring breakup along the river, oil entrained in river sediments might flow under the shorefast sea ice at the river mouth and flow offshore and sink over at least part of the Boulder Patch habitat. Such an oil-spill event probably would pose a greater threat to the Boulder Patch than an offshore oil spill. If such a severe event occurred, the oil-spill effects on the productivity and diversity of (perhaps 20%) Boulder Patch benthic organisms could persist for more than 10 years due to lethal and sublethal effects of the oil on benthic invertebrates of the Boulder Patch communities.

The past construction of a gravel drilling island off Beechey Point in Stefansson Sound very near Boulder Patch habitat in support of State of Alaska offshore oil and gas exploration in the Beaufort Sea had resulted in increased water turbidity that apparently affected the linear growth of the Boulder Patch kelp blades located within 380 meters of the gravel island. The formation of turbid ice that might be due to the presence of the island also may have contributed to a small degree to the turbidity that reduced growth and tissue density in the Boulder Patch kelp. However, kelp plants within 380 meters of the island did not have significantly lower carbon concentrations (a potential indicator of plant health) than control kelp plants. The increased water turbidity and presence of cloth fragments from the island's gravel bag protective beach barriers has had no apparent effects on the invertebrate species of the Boulder Patch kelp communities.

If further gravel island construction occurs in Stefansson Sound near the Boulder Patch habitat, an accumulative and more continuous increase in water turbidity is expected to reduce kelp growth and vitality over more of the Boulder Patch habitat and could result in long-term (more than 10 year) reduction in the growth of the kelp beds, which would lead to a long-term (more than 10 year) decline in the Boulder Patch benthic communities.

Of the 275 miles of offshore pipeline assumed to be laid under the cumulative case, a pipeline route from an OCS oil field offshore of Stefansson Sound is assumed to be laid and buried across Stefansson Sound connecting to the present Endicott pipeline. The burial of the pipeline and potential construction of a short causeway (1,000-2,000 feet) is expected to increase water turbidity and sedimentation in Stefansson Sound, temporarily affecting the growth (perhaps 1-2%) of Boulder Patch kelp beds for about 2 years during construction activities.

Under the cumulative-case scenario, a 20,000-bbl-pipeline oil spill is assumed to occur in Stefansson Sound near the Boulder Patch. Most of the oil from the buried pipeline is expected to float to the surface after contaminating bottom sediments within about 100 meters of the pipeline. A small portion (perhaps 10%) of the Boulder Patch benthic habitat is expected to be exposed to hydrocarbons in the water column for the duration of the spill, and potential effects on productivity are expected to last for no more than 2 years.

In summary, the cumulative effects on Boulder Patch marine plants and invertebrate communities from potential oil spills associated with existing onshore Endicott pipeline crossings of the Sagavanirktok River and assumed offshore pipeline spill (20,000 bbl) associated with the proposal could have long-term (more than 10 years) effects on the productivity and diversity of Boulder Patch benthic invertebrates. The contribution of the proposal (offshore pipeline spill) to this effect is expected to be less than 20 percent. Past gravel island construction in association with State of Alaska offshore oil and gas exploration in Stefansson Sound has had some effects on the growth of Boulder Patch kelp within 380 meters of the gravel island, while the construction of the Endicott causeway shoreward of the Boulder Patch habitat has had no lasting effects on the kelp or benthic invertebrate communities of the Boulder Patch. The assumed laying and burial of an offshore pipeline crossing Stefansson Sound under the Proposal and potential construction of a short causeway is expected to temporarily reduce the growth of some (perhaps 1-2%) Boulder Patch kelp beds during construction activities, with effects lasting for no more than 2 years.

If future gravel island and causeway construction occurs in Stefansson Sound near the Boulder Patch habitat, an accumulative and more continuous increase in water turbidity is expected to reduce kelp growth over more of the Boulder Patch habitat and could result in long-term (more than 10 year) decline in the abundance and distribution of the Boulder Patch benthic invertebrates through degradation of their kelp habitat. The contribution of the Proposal to turbidity effects on the Boulder Patch is expected to be perhaps less than 20 percent.

CONCLUSION: For the cumulative case, the effects of oil spills on the Boulder Patch communities are expected to result in a reduction in species diversity and abundance of benthic invertebrates (perhaps 20%), with effects lasting for more than 10 years. The contribution of the proposal to this effect is expected to be less than 10 percent. Cumulative gravel island and causeway construction and offshore pipeline burials are expected to increase water- turbidity effects on the growth of Boulder Patch kelp beds. Such reduction in growth could lead to a long-term (more than 10 year) decline in the abundance and productivity of Boulder Patch benthic invertebrates. The contribution of the proposal to the cumulative increase in water-turbidity effect is expected to be perhaps less than 20 percent.

(c) Pacific Region

1) Intertidal Benthos

Factors that may produce cumulative effects on intertidal benthos in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to intertidal communities in U.S. waters include increases in municipal and industrial discharges, human gathering/trampling, and Alaskan and foreign-import tankering.

For decades (Frey, 1971) it has been known that the greatest damage to rocky intertidal communities on the mainland coast of the Southern California Bight is due to human trampling, collecting, gathering and simple disregard for the delicateness of the area. Invertebrates are collected for food, bait and specimens. There are also indirect effects of collecting: mussel clumps are torn apart during searches for worms used as bait, boulders are overturned and left, while clam diggers leave highly disturbed depressions in boulder fields. During the last two decades as immigrants from cultures which gathered food from intertidal areas in their native country, destruction of intertidal areas from food gathering has increased even further.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in Section IV.D.1.c. Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986). Although greater strides will be made to decrease or at least limit the amount of sewage entering the southern California region, with a projected 50 percent increase in the coastal population by the year 2010 (Section IV.D.1.c), it is assumed that pollution effluents will continue to increase or, at best remain at the present level over the next 35 years.

Littler (1979) noted decreased species diversity at rocky intertidal sites near large population centers, particularly near the Whites Point outfall in San Pedro Bay. Pollution was believed to be a major factor in this decrease, but is always accompanied with human disruption near large population centers including central California near San Francisco and, to a lesser extent, the Pacific northwest.

Thompson et al. (1990) and Littler (1979) suggest that much of the area in the Santa Barbara Channel adjacent to the 87 tracts is less disturbed than around Los Angeles. In the western portion of the bight, from Gaviota to Point Conception, access to the intertidal is limited and intertidal communities are nearly as pristine as anywhere on the California coast. From Gaviota to Ventura, human population density is quite low, many intertidal areas are not easily accessible, and the intertidal is less disturbed than further south. Thompson et al. (1990), however, class the entire area from Ventura to San Diego as being subjected to intense collecting and trampling since they border densely populated urban areas.

Due to further population increases in virtually all coastal metropolitan areas, rocky intertidal, and in certain areas adjacent to calm seas and large cities, sandy beach intertidal communities will continue to decrease over the next 35 years.

It is assumed that one pipeline from an existing lease will be constructed to a shoreline landfall in the northern Santa Maria Basin. Due to the large area of sandy beach intertidal habitat in the area and greater ease of bringing a pipeline ashore across a sandy beach rather than a rocky beach, it is assumed that the pipeline will cross a sandy beach intertidal area. Impact to the intertidal community will occur and be limited to the 20 m wide pipeline corridor and will involve an initial mortality or outward migration of the majority of intertidal animals in the corridor. Recovery will be complete along the corridor (except on the pipeline) within two years.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on benthic communities. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

It is assumed for the cumulative case that a total of 17 spills (ranging in size from 7,000 to 30,000 bbl) will occur in the Pacific Region over the 35-year life of the proposed action (see Table IV.D.1.c-4). This total includes 5 TAPS tanker spills, 5 import tanker spills, and 7 OCS spills. The OCS total includes a combination of spills from platforms, pipelines, and the tankering of Alaskan OCS oil. Assuming uniform distribution of spills, the average number of spills per year from all these sources is approximately 1 spill every 2 years.

Impacts on intertidal communities have been discussed in Section IV.D.1.a(9). The severity of impact is variable with sea state, residence time of the oil prior to contact, isolation and configuration of the intertidal site contacted. Oil spills contacting major isolated rocky intertidal areas along the Pacific Region Coast (see USDOI, 1983b, c for a list of these areas) would cause noticeable mortality of thousands of individuals and alteration of ecological relationships within the rocky intertidal community. Recovery could be retarded in some species for a year and different assemblages within the community could require at least 6 years to return to pre-spill conditions. Similar impacts would occur if such a spill contacted the more biologically sensitive rocky intertidal habitats in the Point Conception – Point Buchon area and the Channel Islands in southern California. Noticeable mortality of much of the community would occur with recovery requiring, possibly up to 10 years. Impacts of this severity to rocky intertidal communities would extend horizontally along the coast for several miles. Relative to the entire coast of the Pacific Region, 17 spills even if they all contact rocky intertidal areas is a very small portion of the coast, far less than one percent. Oil spill impacts will not be discernible from normal community fluctuations caused by natural variability when the overall region is considered.

The impacts of a spill (greater than or equal to 1,000 bbl) on sandy beach intertidal communities would include smothering and immobilization of species such as the sand crab (*Emerita* sp.), beach hoppers (*Orchestoidea* sp.), and polychaete worms (such as *Euzonous* sp.). Recovery of the sandy beach biota would be expected to occur in less than one year since most of the sandy beach communities contain fast-growing and highly mobile organisms that have adapted to the constant physically disturbed environment of shifting sands (ADL 1985; Chambers Group, Inc., 1986). As with rocky intertidal communities, these impacts will not be discernible from normal community fluctuations caused by natural variability when the overall region is considered.

The 17 multiple spills expected to occur in the Pacific Region should alter several areas along the coast for a decade or longer and compound anthropogenic impacts mentioned above to further decrease the diversity of at least rocky intertidal areas around already large and other growing metropolitan areas of some locations along the entire Pacific coast.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the spills greater than 1,000 bbl discussed above. Assuming that a small spill contacts intertidal communities, the loss of a few individuals which would not be discernible from normal population fluctuations nor cause interference with ecological relationships is expected.

In summary, non-OCS activities, due to human trampling, collecting, gathering and pollution discharges directly or indirectly related to further population increases in virtually all coastal metropolitan areas, intertidal communities will continue to decrease over the next 35 years. Routine OCS activities associated with the proposed action are expected to involve a 20 m wide two year long impact on a sandy beach in the northern Santa Maria basin. Accidental oil spills from both non-OCS and OCS sources are expected to result in smothering and immobilization to portions of local sandy beach populations of several species limited to the area contacted by the spill with recovery occurring within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community limited to the are contacted by the spill. Recovery could be retarded in some species for a year and different assemblages within the community could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblage or communities at local areas with the region will not cause interference with ecological relationship on a regional basis.

CONCLUSION: Healthy intertidal communities in the Pacific Region, particularly rocky habitats, will continue to decline during the next 35 years. The primary cause of the decline will continue to be human usage and, to a lesser extent domestic and industrial pollution. Impacts from routine OCS operations and from the assumed spills will not be discernible from normal community population fluctuations within the Pacific Region overall.

2) Subtidal Benthos

Factors that may produce cumulative effects on subtidal benthos in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to subtidal U.S. waters include increases in municipal and industrial discharges, commercial fishing operations, and Alaskan and foreign-import tankering.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in section IV.D.1.c. Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986). Measurable impacts to benthic communities, however, are limited in horizontal extent. Even in Santa Monica Bay during possibly its most polluted period, altered benthic assemblages near outfall pipes were limited to areas on the order of a few thousands of meters, while much of the remainder of the bay possessed assemblages similar to others throughout the bight at similar depths (USDOI, MMS, 1978b). Since the large municipal and industrial wastewater outfalls are south of the 87 tract area, the benthic environment apparently remains relatively unaltered throughout most of the area. Although greater strides will be made to decrease or at least limit the amount of sewage entering the southern California region, with a projected 50 percent increase in the coastal population by the year 2010 (Section IV.D.1.c), pollution and its effect on southern California benthic communities will maintain at its present level over the next 35 years.

Fishing, particularly through the use of otter trawls and anchors alters the composition of benthic assemblages within the areas fished. There is little recorded evidence, however, that these impacts are long lasting on soft bottom communities and that, generally, recovery by vertical and horizontal migration can occur within a year. Although trawlers often avoid higher relief rocky outcrops to prevent hanging up their nets on them, impacts to these bottom types do occur. Recovery on this bottom type, involving the mortality of hundreds to thousands of individuals, would require at least five years.

Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms are expected to occur at some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time. In addition there will be a total of 17 pipeline corridors running for 120 miles.

It is also assumed that one pipeline, from an existing lease, will be constructed to a shoreline landfall in the northern Santa Maria Basin.

Platform and pipeline installation would cause additive, but probably not synergistic impacts on the subtidal benthos in the 87 tract area. The amount of physical disturbance of the ocean bottom from platform installation depends on the type of substrate (soft vs hard bottom) and on the number of platforms being installed. Habitat modification (crushing) of the bottom area during the platform installation process would cause localized impacts on the soft bottom subtidal benthic fauna involving noticeable species changes and mortality of thousands of individuals in an area having a radius of slightly over 100 m lasting for the life of the platform. However, as suggested above, impacts on the southern California region would most likely be indistinguishable from natural fluctuations.

Should installation of a production platform occur on or near a hard bottom area such as a rock outcrop or reef, much of the bottom community beneath the platform to a radius of approximately 100 m would be destroyed or the community severely altered. Recovery would require many additional years (5 to 15) after the platform is removed due to the scarcity of hard bottoms as a biological resource and the long recovery period of hard bottom organisms.

The installation of pipelines and their associated anchoring activities on benthic habitat areas would crush attached hard bottom organisms, as well as physically displace some of the biota and hard substrate in the construction corridor (approximately 20 m or 65 ft wide) and a total of 120 miles long. On certain soft bottom areas, anchor scars can cause concern. The anchor scars would serve as traps for fine sediment and organic material. Therefore, the resulting microhabitat from this disturbance (sediment alteration) in the affected areas could be different from that of the surrounding environment resulting in a change in species composition since soft bottom infauna are dependent upon grain size of the sediment.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on benthic communities. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

Impacts on benthic communities from oil spills have been discussed in Section IV.D.1.a(9). The habitats most sensitive to impacts are hard bottoms and shallow areas. Impacts from a spill (1,000 bbl or more) on hard bottoms would involve a noticeable, mortality, involving thousands of individuals, of the hard bottom community contacted. Alterations of ecological relationships lasting for at least two years would be expected. Impacts on shallow water bottoms, especially near the Channel Islands, would be mortalities requiring two to more than five years (species dependent) to recover. The impacts and recovery period just described would be essentially the same within the Pacific Region.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action. These small spills, although chronic, will provide a very minor input of oil into the marine environment in comparison with the larger spills discussed above, and are expected to result in the loss of a few (tens to hundreds) individuals within the area contacted, but would not be discernible from normal population fluctuations.

In summary, impacts from industrial and domestic sewage will continue to affect subtidal benthic communities within hundreds of meters of the outfalls. Although the amount of these pollutants should increase with continued population increase in the municipal area the bight, impacts will be limited in horizontal extent and the benthic communities over the proposal will remain approximately the same.

Routine activities on the subtidal benthos are not expected to measurably impact subtidal organisms in the Pacific OCS Region. However, local impacts involving mortalities of thousands of individual and lasting the like of the platform could occur if platforms or pipelines occurred on or within 100m (330 ft) of hard bottom features.

An oil spill will resulting the loss or functional disruption of a few assemblages or communities at local areas with the region. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of the hard bottom community contacted causing alteration of ecologic relationships lasting for at least two years.

CONCLUSION: The benthic communities of the Pacific will remain unchanged overall with specific local areas (measured in acres) in shallower water near large cities experiencing mortalities of thousands of community members. The majority of these impacts will continue to be caused by industrial and domestic sewage discharges and the effects will be measurable for decades. The majority of impacts from platform and pipelines on soft bottom areas in deeper waters will be measured in hundreds of meters and last for the life of the project Impacts from these routine operations and the assumed oil spills will not be discernable from normal fluctuations in benthic community populations within the Pacific Region.

(d) Atlantic Region

1) Benthic Communities

Under this scenario, routine OCS activities which are expected to impact benthic communities in the Atlantic Region include oil and gas activities as described in Section IV.D.1.b. Impacts from these activities are similar to those described in Section IV.D.1.a. Other potential OCS activities which are expected to impact benthic communities during the next 30 years include mining of hard minerals. Sand and gravel mining currently takes place in state waters (e.g., New York) and is expected to occur on the OCS over the next 30 years. Phosphate is currently mined onshore in North Carolina, but environmental concerns in the State could force the closure of this operation, making mining on the OCS an attractive alternative. Interest also has been expressed in mining manganese nodules on the Blake Plateau as well as ilmenite (the main ore for titanium) found in placer sands off Virginia. Non-OCS activities which are expected to impact benthic communities include tanker transport of imported oil through the region, municipal and industrial outfall and runoff into the marine environment, and ocean dumping.

Under this scenario, foreign imports of crude oil through the region is assumed to result in a total of 13 oil spills greater than or equal to 1,000 bbl. Twelve of these spills are assumed to occur in the mid-Atlantic. Twenty-three small spills (1 to 50 bbl) as well as one spill from 50 to 1,000 bbl are also assumed under this scenario.

The primary impact on benthos from routine activities will be the burial of benthic communities by drilling discharges (primarily cuttings) in the vicinity of the wellheads. These impacts are expected to occur primarily to offshore benthic communities while nearshore benthic communities are expected to be impacted by pipelaying operations (see Section IV.D.1.a). With the exception of manganese nodules and certain phosphate deposits, hard minerals are extracted by dredging the seafloor. Dredging will result in destruction of benthic communities and alteration of the substrate. Because most of the dredging would occur in nearshore areas, recovery is expected to occur within one to two years but may result in the development of a different community. However, large accumulations of drilling discharges around platforms, and to a lesser extent from exploration and delineation, will result in long-term alteration of the sediment structure with the likelihood that recolonization will require several years and result in a substantially different community from the original one.

Municipal and industrial outfalls and runoff into the marine environment are expected to increase as population density increases along the coast, resulting in increased inputs of pollutants to the marine environment. Many of the nearshore benthic communities in coastal areas are already suffering from degraded water quality, causing the closure of important shellfishing areas (Section IV.D.1.c). At least part of the decline of the oyster industry (and shellfish, in general) in the Atlantic Region has been due to the loss of harvestable bottom areas because of pollution, coastal development, farming, and forestry (Burrell, 1986). This trend is expected to continue over the next 30 years.

The extent of impacts on benthos from an oil spill 1,000 bbl or greater depends on whether the spill occurs in nearshore or offshore waters and the persistence and bioavailability of the hydrocarbons. Nearshore benthic organisms are more vulnerable to the effects of a spill than offshore ones (Section IV.D.1.a). Although sedimentation of oil seems to be a general process that occurs from oil spills and chronic discharges (Teal and Howarth, 1984), small oil spills are not expected to have a significant effect on benthos because of the water depths at which the majority of the proposed lease blocks occur. In offshore waters, even large tanker spills such as the *Argo Merchant* have not resulted in significant concentrations of oil in the sediments (MacLeod et al., 1978).

Under this scenario, the primary impact on benthos from routine OCS activities will be the burial of benthic communities primarily by drill cuttings in the vicinity of the wells along the outer continental shelf and the destruction of communities and habitat in areas of sand and gravel mining. Large accumulations of drilling discharges around platforms, and to a lesser extent from exploration and delineation activities, will result in long-term alteration of the sediment structure with the likelihood that the recolonizing community will be substantially different from the original one. Because of the depths at which the activities are expected to occur, recovery of the benthic community could take several (3 to 5) years. Nearshore areas impacted from pipeline operations probably would recover more quickly (within 1 to 2 years), but also could result in an altered benthic community. Hard mineral mining also will result in destruction of the affected seafloor, with recovery taking one to several years. Impacts from oil spills will result in massive deaths of benthic organisms if oil contacted nearshore communities, but few effects are expected if an oil spill occurs over deepwater communities. Although efforts are being made to address the problems of pollution along the coast, increasing development pressure, loss of wetlands, and runoff from urban areas, farming, and forestry, will continue to stress the nearshore benthic communities.

CONCLUSION: Under the cumulative scenario of the proposed action, impacts on benthic communities are expected to result in changes in the distribution or abundance of benthic organisms in affected areas which will last up to 5 years. The major source of impact will be nearshore pollution from non-OCS sources.

2) Submarine Canyons

Under this scenario of the proposal, routine oil and gas activities which are expected to impact submarine canyons are similar to those described in Section IV.D.1.b. Because submarine canyons are located far from any of the potential mining operations for hard minerals, no other OCS activities are expected to affect these areas. Non-OCS activities which are expected to impact submarine canyons include municipal discharges, ocean dumping, tanker transport of imported oil, and commercial and recreational fishing. Submarine canyons could be identified by the RD as biological resources requiring special protection as outlined in Section IV.D.1.a.

Under the cumulative-case scenario, a total of 13 spills greater than or equal to 1,000 bbl from tankering imported oil, 23 small operational spills (1 to 50 bbl), and 1 spill of 50 to 1,000 bbl are assumed under this scenario.

Submarine canyons act as conduits for sediments from the shelf to the slope, allowing pollutants discharged into the coastal marine environment which become bound to sediments to reach submarine canyons. These pollutants include anthropogenic hydrocarbons, primarily from the burning of fossil fuels (Boehm, 1989). Data from studies of Georges Bank suggest that, although introduced pollutants may be deposited at canyon heads and transported down the canyons, up-canyon transport and deposition of sedimented pollutants at canyon heads is also possible (Boehm, 1989). Moreover, frequent resuspension of fine-grained sediments in canyons increases the opportunity for particulates to adsorb dissolved materials and strip them from the water column (Bothner, 1989). Thus, submarine canyon heads act as sinks for many contaminants (for a detailed discussion, see Section IV.D.1.a). Although ocean dumping will cease after 1991, pollutants from existing dumpsites also could be remobilized and transported to canyon heads. Therefore, the current burden of pollutants, including hydrocarbons, from municipal, industrial, and other anthropogenic sources suggests that contaminants will continue to accumulate in the fine sediment fraction found at canyon heads during the next 30 years. The long-term effects of this input of pollutants on submarine canyons are unknown.

Under this case scenario, no oil spills are assumed to occur in the North Atlantic where many of the Atlantic Region's submarine canyons are located. By contrast, there are no submarine canyons in the South Atlantic where one oil spill is assumed to arise from tankering of imported oil. However, many submarine canyons exist in the mid-Atlantic where 8 oil spills of 1,000 bbl or greater are assumed to occur. As with other pollutants, canyon heads are likely sites for the accumulation of sedimented hydrocarbons. Therefore, hydrocarbons from the assumed oil spills, bound to particulates and eventually incorporated into fine-grained sediments, eventually are expected to reach submarine canyons. However, anthropogenic sources are expected to be a more important source of hydrocarbon contamination since chronic inputs (e.g., municipal, industrial, and atmospheric sources) contribute approximately half the hydrocarbons introduced into the marine environment (NRC, 1985a). Moreover, even large tanker spills have not resulted in hydrocarbon accumulations in the sediments which have produced measurable effects (Macleod et al., 1978; Teal and Howarth, 1984; Howarth, 1989).

Submarine canyons contain several commercially and recreationally important species of fish (Section III.D.2.f.). In fact, canyons represent a large fraction of the fishing grounds for some species, with approximately 75 percent of the offshore lobster catch and 95 percent of the tilefish catch emanating from submarine canyon populations (USDOI, 1989). Although mobile fishing gear is not used in canyons, commercial (and to a lesser extent, recreational) fishing with fixed gear is expected to produce the most important impacts on submarine canyon communities by removing annually a significant portion of targeted species. Because fishing pressure from increased product demand and improved fishing methods is expected to increase, fishing mortalities also can be expected to increase over the next several decades (see Section IV.D.1.c(11)).

If submarine canyons are not identified as biological resources requiring special protection, impacts to submarine canyons associated with routine activities would result primarily from activities associated with drilling of exploration, delineation, and development wells (Section IV.D.1.a).

It is likely that coastal development, urban and agricultural runoff, and fishing pressure will continue to increase in the Atlantic Region over the next 30 years. Increased transport of pollutants from coastal areas across the outer continental shelf can be expected to result in increased concentrations of these substances, including hydrocarbons derived principally from the burning of fossil fuels, in the heads of submarine canyons. This burden of pollutants, combined with increased fishing pressure (primarily commercial) can be expected to further stress submarine canyon communities.

CONCLUSION: Population declines in submarine canyons can be expected under the cumulative scenario of the proposed action. The major source of these declines is expected to be commercial fishing. These declines will result in changes in the distribution and/or abundance of certain species locally and/or regionally. The expected duration of the impacts is 3 to 5 years.

(10) Impacts on Coastal Communities

(a) Gulf of Mexico Region

1) Demography and Employment

The cumulative analysis will focus on the direct, indirect, and induced impacts of the OCS oil and gas industry on the demography and employment of the counties and parishes of the Gulf of Mexico socioeconomic impact area as a result of prior sales, the proposed sales, and future sales in the Gulf of Mexico. Also considered, are employment impacts associated with the clean-up of oil spilled during import tankering operations and the transportation of oil from the TAP system. There would also be other economic impacts, both direct and indirect, associated with the proposal due to its effect on other industries, such as commercial fishing, tourism, and recreational fishing. The direct benefit or loss in these industries is addressed in the sections of this EIS related specifically to those topics. The proposed proposal's indirect and induced effect on these associated industries is much more difficult to quantify. Nevertheless, it will generally constitute a fraction of the magnitude of the direct impact.

The Gulf of Mexico Region accounted for 13 percent of the total U.S. coastal population in 1988, with the Gulf of Mexico socioeconomic impact area totaling approximately 14 million inhabitants (USDC, NOAA, 1990). The current employment estimate for the impact area is approximately 6.5 million for 1990. Section III.A.3 provides a more detailed discussion of the employment and demographic conditions within the socioeconomic impact area of the Gulf of Mexico Region. Also included in that section, is a description of the Gulf of Mexico socioeconomic impact area, as well as future projections of population and employment levels for the Region. The methodology developed to quantify the cumulative scenario impacts to demography and employment takes into account changes in OCS-related employment, along with population and labor impacts resulting from these employment changes in the coastal communities of the Gulf of Mexico Region. For a detailed description of the methodology used in this analysis turn to the base-case analysis of demography and employment in this EIS.

Projected changes in the industrial composition of the regional economy over the life of the proposed action are considerable (USDOC, NOAA, 1990a). Mining employment is expected to decrease in Texas, Louisiana, Mississippi and Alabama. By the year 2020, mining employment in Texas is projected to decrease by about 16 percent from 1988 levels. The highest growth sector in the state of Texas through the year 2020 will very likely be the service industry. By the year 2020, this sector is expected to grow by about 40 percent from employment levels experienced in 1988. Retail trade is another high growth industry in the State of Texas over this time period. By the year 2020, mining employment in Louisiana is projected to decrease by about 20 percent from 1988 levels. The construction industry in Louisiana will also experience a significant decline of approximately 11 percent over this time period. The growth sector in Louisiana through the year 2020 will very likely be the service industry. This comes as no surprise, considering the State's efforts to strengthen existing tourism activity in the region. Mining employment in Mississippi and Alabama is expected to decline by 13 percent and 10 percent, respectively. The highest growth sector in these two states is also the service industry. By the year 2020, the service sector in both Mississippi and Alabama is projected to grow by about 30 percent from employment levels experienced in 1988. Mining employment is expected to increase slightly in the state of Florida, approximately 3 percent by the year 2020. The service industry in Florida is projected to grow by 56 percent from employment levels experienced in 1988. Retail and wholesale trade are also expected to exhibit relatively large growth in employment levels.

A number of oil spills resulting from the import tankering of crude oil and the coastwise movement of petroleum products are assumed to occur and may affect recreational beaches, however, their impact is negligible from an employment and economic standpoint.

Under the cumulative scenario, the proposal is expected to result in the drilling of 12,050 exploration and delineation wells and the emplacement of 518 platforms from which 7,780 oil and gas development wells will be drilled. In support of this activity, a total of approximately 2,691,500 person-years of employment (direct, indirect, and induced) are required during the 45-year life of the proposed action. Peak levels of employment are expected to occur in the year 2000 with a total of approximately 79,900 workers involved in primary, secondary, and tertiary industries. Direct employment in the primary oil and gas extraction industry (SIC 13) accounts for 45 percent of the total employment projected to result from the proposed action in the coastal communities of the Gulf of Mexico Region over its 45-year life. Exploratory activities are the main contributor to peak year direct employment impacts. After their peak in 2000, total employment impacts begin to decline as oil and gas exploration is reduced in areas leased under the proposed action. Peak employment impacts resulting from development activities take place in 1992, the first year of the life of the proposed action. Even though exploratory activities drive peak year employment impacts, the greatest contributor to overall employment impacts is production operations. Employment in oil and gas production activities accounts for over 70 percent of total direct employment impacts from the proposed action. Indirect and induced employment impacts in secondary and tertiary industries amount to approximately 30 percent and 25 percent, respectively, of the total employment impacts over the 45- year life of the proposed action.

The greatest impact to employment is expected in the coastal communities of Louisiana. The States of Louisiana, Mississippi, and Alabama collectively provide almost 85 percent of the total employment required in support of the proposed action. Texas contributes over 13 percent of the Gulf Region employment impact, with peak levels of approximately 10,970 employees occurring in the year 1999. The least impacted State in the Gulf of Mexico Region is Florida, accounting for only two percent of the employment impact projected for the socioeconomic impact area as a result of the proposal. Peak employment impacts for Florida are projected to occur in the year 2005, with approximately 2,110 people employed in support of the proposed action.

The level of OCS-related employment expected to result from the proposed action under the cumulative-case scenario is not significant enough to attract new residents and labor force to the area. An analysis of historical population statistics for the Region shows that net migration to the Region is typically associated with a larger level of new employment opportunities and associated population impact. Jobs are expected to be filled by currently unemployed and underemployed workers or by future entrants into the labor force already living in the area. Therefore, employment demands in support of the proposed action will be met with the existing population and available labor force. It appears that the growth in employment to levels expected in the year 2000 will represent the peak impact of the OCS program over the life of the proposed action. Future OCS leasing is only expected to partially offset the declining level of activity already taking place in the oil and gas industry offshore. Similar declining trends are projected for oil and gas production in state waters.

Employment impacts resulting from oil spill clean-up activities, because of their highly unpredictable nature, were handled separately. The level of employment associated with any given clean-up operation is dependent on numerous variables which, in themselves, are also difficult to predict. Nevertheless, the most labor-intensive clean-up operations are those from spills that contact the coastline, particularly recreational beaches. For the purpose of this analysis, it is assumed that only those spills contacting land will involve significant manpower requirements in their clean-up efforts. Based on employment statistics from recent spill clean-up operations along the coast, the assumption is that for every kilometer of coastline subjected to heavy oiling, approximately 100 temporary workers will be employed for a maximum of 6 weeks.

Several different types of oil spills are assumed to occur under the cumulative-case scenario of the proposed action. It is assumed that 10 spills greater than or equal to 1,000 bbl will occur from program-related activities Gulfwide. Two oil spills (one 18,000 bbl platform spill and one 25,000 bbl pipeline spill) would occur offshore Texas, seven oil spills (three 18,000 bbl platform spills and four 25,000 bbl pipeline spills) would occur in the northcentral Gulf offshore Louisiana/ Mississippi/Alabama, and one 25,000-bbl pipeline spill would occur in the northeastern Gulf offshore Florida. Based on a 20 percent chance of coastal contact from these spills, it is assumed that two spills will contact the Gulf Coast. Considering the location of oil pipelines and platforms offshore, and the pattern of coastal ocean currents, the most likely location for contact from these spills is along a stretch of coast extending from western Louisiana to eastern Texas and along the Mississippi/Alabama coast. It is assumed that as much as 75 percent of the original volume of oil from the spill source will be lost as a result of weathering processes by the time the slick contacts the coastline. Considering all the losses of oil from the original spill, it is assumed that approximately 50 km of beach and 25 km of inshore shoreline could be affected per spill. In addition, a total of 70 ha of wetlands could be affected by the 2 spills which are assumed to contact the coastline. However, it is assumed that wetlands and inshore shoreline areas affected by the spill will not be cleaned because clean-up activities in these habitats are believed to cause more damage than the oil itself.

Therefore, it is expected that only the affected beach areas will be cleaned. Using employment statistics from recent spill clean-up operations along the coast, it is assumed that for every kilometer of coastline subjected to heavy oiling, approximately 100 temporary workers will be employed for a maximum of 6 weeks. Based on these assumptions, an estimated 5,000 workers will spend approximately 6 weeks employed in operations supporting the clean-up of each (1,000 bbl or greater) spill. For the two OCS spills (1,000 bbl or greater) assumed to contact the coastline, this estimate is equivalent to a total of 1,150 person-years of employment over the life of the proposed action. No spills of 1,000 bbl or greater are assumed to occur and contact the Florida coast because of the prevailing currents offshore northwest Florida and the small amount of oil resources expected to be developed in that area of the Gulf of Mexico. Furthermore, if a spill does occur offshore Florida, it would occur as a result of oil in transit, and would occur far from shore, thus minimizing the chances of contact to the coast. In the unlikely event of an oil spill occurring near the Florida coastline, two oil spill response stipulations are in place to protect Florida's coast from damaging oil spill contacts.

About 37 small spills (greater than 50 bbl and less than 1,000 bbl) and 985 chronic spills (greater than 1 bbl and less than 50 bbl) are assumed to occur as a result of the proposed action under the cumulative-case scenario. Many of these spills will be only a few barrels in size, and many others will occur so far from shore that no oil will contact the coast. Fewer than 7 small spills and fewer than 50 chronic spills are assumed to contact the coastline. An additional 152 oil spills (less than 50 bbl) are assumed to occur from onshore support activities, but only 25 percent of these spills are assumed to be greater than 10 bbl. Furthermore, these spills will occur near support facilities which are not usually located in close proximity to areas of significant recreational beach activity. Based on these assumptions regarding spill size, distance from shore, and location, small and chronic spills are not expected to involve significant employment in clean-up operations.

In light of the past and projected decline in oil and gas activities in Gulf of Mexico Region, particularly Texas and Louisiana, there are numerous and significant efforts to diversify the local economies. A diversified economy will provide the coastal communities the opportunity to achieve net economic growth in spite of the downturn in the oil and gas industry.

In summary, projected changes in the industrial composition of the regional economy over the 45-year life of the proposed action are considerable. Mining employment is expected to decline in all Gulf States, with the exception of Florida where it is projected to increase slightly. Over the next 3 decades, the service industry is expected to exhibit the highest growth in the Gulf Region. There are currently numerous effects underway to diversify the local economics, particularly in the States of Louisiana and Texas.

In support of proposed OCS activities, a total of approximately 2,691,500 person-years of employment (direct, indirect, and induced) are required during the 45-year life of the proposal. The States of Louisiana, Mississippi, and Alabama collectively provide almost 85 percent of the total employment required in support of the proposed action. Texas contributes over 13 percent of the Gulf Region employment impact. The least impacted state in the Gulf of Mexico Region is Florida, accounting for only 2 percent of the employment impact projected for the socioeconomic impact area as a result of the proposal. Employment projected to result from OCS-related oil spill clean-up activities during the life of the proposed action is approximately equivalent to 1,150 person-years of employment. It is expected that employment demands in support of the proposed action will be met with the existing population and available labor force.

CONCLUSION: Under the cumulative-case scenario, the proposed program in the Gulf of Mexico is expected to result in a total of 2,691,500 person-years of employment (direct, indirect, and induced) during the 45-year life of the proposed action. Peak levels of employment are expected to occur in the year 2000, with a total of approximately 79,900 workers involved in primary, secondary, and tertiary industries. Exploratory activities are the main contributor to peak year employment. The incremental contribution of the proposed action to the cumulative impact level is minimal because employment demands in support of the proposed action are expected to be met with the existing population and available labor force. Considerable change is expected in the industrial composition of the regional economy during the 45-year period. Mining employment is expected to generally decline, the service industry is expected to have high growth, and diversification is expected in local economies, especially in Louisiana and Texas.

2) Public Services and Infrastructure

The Cumulative Analysis considers the effects of OCS-related, impact-producing factors from the Northcentral, Northwestern, and Northeastern Gulf of Mexico as well as the effects of prior, current, and future OCS sales. The analysis also considers the effects of certain non-OCS-related impact-producing factors. Impact-producing factors considered in the analysis include fluctuations in the work force, net migration, relative income, oil and gas activity from State waters, wetlands loss, and tropical storms. Unexpected events (such as the 1973 Arab Oil Embargo) may influence oil and gas activity within the Gulf of Mexico Region. These events cannot be projected and will not be considered in this analysis.

Public services and infrastructure, as used in this analysis, include commonly provided public, semi-public, and private services and facilities, such as education, police and fire protection, sewage treatment, solid-waste disposal, water supply, recreation, transportation, health care, other utilities, and housing. Changes in OCS activities, as well as changes caused by non-OCS-related, impact-producing factors, could result in changes in demands for and usage of public services and infrastructure. Adverse effects could arise if the amount or rate of increase or decrease in the usage significantly exceeded or fell far below the capability of a local area to provide a satisfactory level of service. In addition, a natural disaster, such as a hurricane, could significantly damage infrastructure and create a greater need for service than would be locally available.

Section III.A.1. provides a perspective of the oil and gas industry, as well as a brief description of recent events that have significantly affected the level of OCS activity in the Gulf of Mexico. Discussions of population, labor, and employment; public services; and social patterns are presented in Section III.A.3.a. As stated in Section IV.D.1.c(10), approximately 2,691,500 person-years of employment (direct, indirect, and induced) are required in the coastal areas of the Northern Gulf of Mexico to support OCS-related activities during the 45-year life of the proposed action. Peak-year impacts are expected to occur in the year 2000 with approximately 79,900 workers involved in primary, secondary, and tertiary industries. Impacts decline after the peak-year, reflecting the projected decline in the level of OCS-related activities. A breakdown of total employment projections for the life of the proposed action reveals total employment of 85 percent in states of Louisiana, Alabama, and Mississippi, with coastal communities of Louisiana expected to experience the greatest impacts to employment; 13 percent of employment impacts are expected to occur in

Texas; and 2 percent of employment impacts are expected to occur in Florida. It is expected that the level of OCS-related employment projected for the CPA will diminish as existing hydrocarbon resources become depleted. It is assumed that continued leasing in the OCS will only partially offset the decline in available OCS-related oil and gas employment.

Fluctuations in the work force as a result of changing levels of OCS-related oil and gas activity could impact public services and infrastructure during the life of the proposed action. As mentioned above, following the peak-year 2000, total employment in the Gulf is expected to decline. Projected changes in the industrial composition of the regional economy over the life of the proposed action reveal a decrease in mining employment in Louisiana of about 20 percent from 1988 levels (USDOC, Bureau of Economic Analysis, 1990). The growth industry in the CPA is expected to be the service industry. It is assumed for the purpose of analysis that the jobs created in the service sector will be lower paying jobs than those in OCS-related activities. This development may result in a lower tax base, making financing for new infrastructure needed in response to normal growth problematic. Layoffs associated with the projected decline in OCS-related employment may place stresses on those private and State agencies responsible for assistance.

Following the peak-year, total OCS-related oil and gas employment in the Gulf is expected to decline. As mentioned above, projected levels of mining employment in Louisiana are expected to drop by 20 percent by 2020. Expected growth in the service industry will most likely provide employment for some of the work force; however, it is assumed that some out-migration will occur among those persons seeking pay comparable to that of OCS-related employment. It is expected that employment needs in support of OCS oil and gas activity are likely to be met with the existing population and available labor force, requiring little to no in-migration. Out-migration could result in a large loss of population, particularly in OCS-related staging and administrative centers. This could stress the public service and infrastructure base of these centers because of dramatic changes in need.

The relatively high wages paid to OCS-related oil and gas industry personnel in the cumulative case will increase the tax base in coastal parishes and counties beyond what could be expected if there were no OCS activities. As OCS-related employment decreases through time, it is assumed that taxes originating from OCS-related wages and expenditures will decrease. Consequently, maintenance of existing infrastructure and creation of new infrastructure may become problematic.

Oil and gas activity within State waters requires similar public services and infrastructure as do OCS-related oil and gas activities. Further, it is assumed that oil and gas employment from activities within State waters will decline at the same rate, if not faster, than that from Federal OCS waters. Infrastructure needs in support of oil and gas activities in State waters would diminish as employment associated with State-regulated activities decline. Impacts to public services would include increased numbers of individuals requiring assistance. In addition, maintenance of existing infrastructure and creation of new infrastructure may become difficult to support at different levels of oil and gas employment.

Experience with hurricanes such as Betsy, Camille, and Fredrick has indicated that major hurricanes can have a devastating effect on both public services and community infrastructure. Assuming that several major storms will impact the Central Gulf coastal subareas during the life of the proposed action necessitates a high likelihood of damage to infrastructure in localized areas of the Gulf as well as stress on public services in those areas.

Section IV.D.1.c(8) states that under the cumulative scenario, massive losses to coastal wetlands is expected to continue along the Gulf Coast. Decreases in sediment load and dispersal, subsidence, indirect impacts from existing canals, and other impact-producing factors are expected to result in the loss of thousands of acres of wetlands per year. However, the incremental contribution of the proposed action, as analyzed in Section IV.D.1.c(8), amounts to several thousand hectares lost over the life of the proposed action as a result of tideland oil and gas development. Given the physiography of the coastal parishes and counties of the CPA and the proximity of much infrastructure to relict geomorphic features, it is reasonable to assume that transportation networks (roads, bridges, and railroads) in the Northcentral Gulf will require increasing maintenance and protection from inundation in the future. This is particularly true in the coastal marsh areas.

In summary, several impact-producing factors will contribute to impacts expected to occur on public services and community infrastructure during the life of the proposed action. Declining levels of OCS-related employment are expected to occur during the life of the proposed action. Economic growth is expected to occur in the service industry; however, the level of pay for these jobs will not be comparable to those lost from OCS-related employment.

It is assumed that some out-migration will coincide with declining levels of OCS-related employment and that it will primarily occur from OCS-staging areas and administrative centers. It is assumed that reduced employment in OCS oil and gas activities will result in a decrease in per capita tax base. This will in turn make maintenance of infrastructure more difficult over the life of the proposed action. Oil and gas activity within State waters is assumed to decline over the life of the proposed action. Impacts to public services would occur as persons formerly employed required assistance. Impacts to community infrastructure would occur as the need for the infrastructure diminished and funding for maintenance and replacement declined. Tropical storm activity has occurred in the past and will occur in the future. It is assumed that several major storms will strike the coastal parishes and counties of the northern GOM during the life of the proposed action. Experience has indicated that these storms could have a major impact on public services and community infrastructure.

Community infrastructure in the coastal parishes and counties is linked to the region's physiography. Continued subsidence and erosion are expected to require expanded maintenance of roads, bridges, and railroads, particularly in the northcentral Gulf of Mexico.

CONCLUSION: Under the cumulative scenario, stress to public services and community infrastructure is expected to occur as a result of declining levels of OCS employment, the effects of relative wages, tropical storms, and wetlands loss. The incremental contribution of the proposed action (as analyzed for the base case in Section IV.D.1.a(10)) to the cumulative impact level is expected to result in minimal impacts to public services and community infrastructure because there are no expected dramatic short-term increases or decreases in population of the coastal parishes and counties. In addition, minimal net migration into the coastal subareas is expected, and employment needs are expected to be met by the existing labor pool.

3) Social Patterns

The cumulative analysis considers the effects of OCS-related, impact-producing factors from the northern Gulf of Mexico as well as the effects of prior, current, and future OCS sales. The analysis also considers the effects of certain non-OCS-related, impact-producing factors. Impact-producing factors considered in the analysis include work force fluctuations, net migration, displacement from traditional occupations, relative income, oil and gas activity from State waters, oil spills, wetlands loss, and tropical storms. Unexpected events (such as the 1973 Arab Oil Embargo) may influence oil and gas activity within the Gulf of Mexico Region. These events cannot be projected and cannot be presumed for this analysis.

Social patterns, as used in this analysis, will include traditional occupations, folkways, social structure, language, family life, and other forms of cultural adaptation to the natural and human environment. It should be noted that impacts not treated in the present analysis (such as technological improvements in communications and transportation) have caused, and will continue to cause, changes within the analysis area. For the purpose of the current analysis, impact-producing factors to social patterns will include work force fluctuations, net migration (both in-migration and out-migration), work scheduling, displacement from traditional occupations (primarily resulting from wetlands loss), relative income, oil and gas activity within State waters, and tropical storms. Adverse effects to social patterns could arise if disruption of social patterns occurred and resulted in changes in traditional occupations, disruption in the viability of extant subcultures, and detrimental effects on family life. It may be argued that employment in the oil and gas industry could be perceived as a traditional occupation. For the purpose of this analysis, such employment will not be considered as a traditional occupation.

Section III.A.1 provides an historical perspective of the oil and gas industry, as well as a brief description of recent events that have significantly affected the level of OCS activity in the Gulf of Mexico. Discussions of population, labor, and employment; public services; and social patterns are presented in Section III.A.3.a.

As stated in Section IV.D.1.c(10), approximately 2,692,500 person-years of employment (direct, indirect, and induced) are required in the coastal areas of the Northern Gulf of Mexico to support OCS-related activities during the 45-year life of the proposed action. Peak-year impacts are expected to occur in the year 2000 with approximately 79,900 workers involved in primary, secondary, and tertiary industries. Impacts decline after the peak year, reflecting the projected decline in the level of OCS-related activities. A breakdown of total employment projections for the life of the proposed action reveals total employment of 85 percent in the states of Louisiana, Mississippi, and Alabama, with coastal communities of Louisiana expected to experience the greatest impacts on employment. Thirteen percent of employment impacts are expected to occur in Texas, and two percent of employment impacts are expected to occur in Florida. It is expected that the level of OCS-related employment projected for the CPA will diminish as existing hydrocarbon resources become depleted. It is assumed that continued leasing in the OCS will only partially offset the decline in available OCS-related oil and gas employment.

The potential effects of work force fluctuations on extant subcultures in the coastal subareas are expected to be greatest when large changes in OCS-related activities result in net positive or negative migration. Under the cumulative scenario, peak-year employment is projected to occur in 2000, with a steady decline in OCS-related employment over the life of the proposed action. It is likely that employment in OCS-related activities will not require importation of labor and that jobs will be filled by the available labor. Projected changes in the industrial composition of the regional economy over the life of the proposed action reveal a decrease in mining employment in Louisiana of about 20 percent from 1988 levels (USDOC, Bureau of Economic Analysis, 1990). The highest growth in the Northcentral Gulf is expected to occur in the service industry. It is assumed for the purpose of this analysis that jobs created in the service sector will be lower paying than jobs in OCS-related activities. The quality of family life, in some individual cases, could be adversely affected from the stress of decreased family income and loss of security resulting from layoffs in the OCS oil and gas industry. As the level of employment in the OCS-related industry decreases, it is likely that more persons will engage in traditional occupations (such as trapping and shrimping) to supplement their income, possibly leading to overfishing of the resource, which could pose a threat to the continued existence of specific traditional occupations.

As mentioned above, projected levels of mining employment in Louisiana are expected to drop by 20 percent by 2020. Expected growth in the service industry will most likely provide employment for some of the work force; however, it is assumed that some out-migration will occur among those persons seeking pay comparable to that of OCS-related employment. It is expected that employment needs in support of OCS oil and gas activity are likely to be met with the existing population and available labor force, requiring little to no in-migration. Out-migration could result in a large population loss, particularly in OCS-related staging and administrative centers. Expected impacts would include a diminishment in the number of those persons engaged part-time in traditional occupations with the possible loss of cultural knowledge, the serious impairment in family life as a result of the departure of extended family members, and potential loss of community cohesion within some of the communities that serve as staging and administrative centers.

Distance to the site and the type of transportation needed for personnel in OCS-related oil and gas activities results in the normal work schedule occurring as a large block of time on duty (or at site) followed by a large block of time off duty. The schedules may range from 7 days on followed by 7 days off to a 30-day on/30-day off schedule. It has been argued that this type of schedule has allowed for participation in, and continuance of, traditional occupations (Laska, pers. comm., 1991).

It is expected that stress will be placed on family life in response to the regular absences of a parent (usually the father). In some cases, it is expected that adaptation to changing family roles will occur. In other cases, it is expected that adaptation will not occur and that there will be deleterious impacts to family life. In the peak year of 2000, 79,900 workers are projected to be involved in primary, secondary, and tertiary industries. Employment in oil and gas production activities is projected to account for over 70 percent of this total. Of those persons employed in OCS-related oil and gas activities and working the extended schedule, it is expected that some families will not adapt to these conditions, and deleterious impacts to family life will occur.

Displacement from traditional occupations could originate from destruction of a resource base, space-use conflict, and voluntary shifts from traditional occupations to employment in OCS-related activities. Adverse effects resulting from displacement from traditional occupations could include a diminishment in the number of participants in traditional occupations, the loss of traditional knowledge and cultural heritage, and deleterious impacts to family life. The existence of the Fisherman's Contingency Fund mitigates, to some extent, space-use conflicts associated with commercial fishing. A total of 1,640 claims have been filed as of 1990; 1,230 of these in the Central Gulf. According to Section IV.D.1.c(8), the cumulative impact to coastal wetlands is expected to result in massive losses of wetlands, particularly in Louisiana. Decreases in sediment load and dispersal, subsidence, indirect impacts from existing canals, and other impact-producing factors are expected to result in the loss of thousands of acres of wetlands per year. However, the incremental contribution of the proposed action, amounts to several thousands of hectares lost over the life of the proposed action as a result of tideland oil and gas development. The loss of habitat in the cumulative case is expected to adversely affect the pursuit of traditional occupations, particularly in Louisiana, over the life of the proposed action. The loss of habitat, over time, could result in a loss of traditional occupations. Deleterious effects to family life could result from displacement and loss of traditional roles.

The relatively high wages paid to OCS-related oil and gas industry personnel may result in the voluntary shift of persons engaged in traditional occupations to more lucrative positions within the oil and gas industry. Dependency on these relatively high wages may deleteriously impact family life, particularly in view of the projected decline in OCS-related oil and gas activity over the life of the proposed action. It is expected that many persons who voluntarily leave traditional occupations for employment in OCS-related oil and gas activities will engage in traditional occupations part-time. Some individual cases of serious impairment of family life is expected to occur in association with those persons who, laid off from OCS-related oil and gas activity during the life of the proposed action, cannot find jobs at comparable pay.

Oil and gas activities within State waters are assumed to result in similar adverse effects as do OCS-related oil and gas activity. It is assumed that oil and gas employment from activities within State waters will decline at the same rate, if not faster, than that from Federal OCS waters. As employment from these activities declines through time, more persons may turn to full-time participation in traditional occupation, resulting in overutilization of the resource and threatening the continuation of traditional occupations. Family life could also be seriously impacted by the suite of impact-producing factors associated with activities in State waters. Experience with major hurricanes in the historical record, as well as modern hurricanes such as Betsy, Camille, and Frederick, has indicated that major hurricanes can have a devastating effect on both the natural and human environment. Temporary disruption of traditional occupations and severe impairment of family life, in some individual cases, can result from the effects of tropical storms. It is assumed that several major storms will impact the coastal parishes and counties of the northern Gulf of Mexico during the life of the proposed action.

In summary, several impact-producing factors will contribute to the high level of impact expected to occur on social patterns during the life of the proposed action.

Declining levels in OCS-related employment are expected to occur during the life of the proposed action. Economic growth is expected in the service industry; however, the level of pay of these jobs will not be comparable to those lost from OCS-related employment. It is assumed that the decline in

OCS-related employment will result in more persons engaging in traditional occupations, resulting in overutilization of the resource base, and threaten the loss of traditional occupations. Serious impairment of family life is expected to occur in some individual cases.

For the life of the proposed action, OCS-related jobs are expected to be filled by the available labor pool. No in-migration is projected for the coastal subareas. Out-migration may occur as a result of persons seeking pay comparable to that earned in OCS-related industries. Comparatively large amounts of out-migration may occur within localized communities that serve as OCS-related staging and administrative centers, resulting in deleterious impacts to family life in some individual cases. The loss of some persons engaged in the part-time pursuit of traditional occupations would also occur.

The specialized schedule that is necessary for the operation of many OCS-related activities is expected to impair family life seriously in the case of families unable to adapt to changing roles. Deleterious effects on traditional occupations are mitigated by schedule flexibility that allows for part-time participation in traditional occupations.

Displacement from traditional occupations could occur as a result of destruction of the resource base (primarily loss of wetlands), space-use conflicts, and voluntary shifts from traditional occupations to OCS-related employment. The loss of wetlands under the cumulative case is expected to be massive. This loss, through time, is expected to impact seriously traditional occupations, cultural heritage, and family life; it may result in the loss of traditional occupations.

Adverse effects from relative wages are expected to be greatest among families who have grown dependent upon the relatively high level of wage paid to persons employed by OCS-related industries. Serious impairment of family life is expected to occur in some individual cases.

Oil and gas activity within State waters is assumed to decline at the same rate, or at a faster rate, than that projected for Federal OCS waters. Impact-producing factors are expected to parallel those found for activity in Federal OCS waters. The levels of impacts are expected to parallel those found for OCS-related activities.

It is assumed that several tropical storms will make contact with the coastal areas during the life of the proposed action. Experience has shown that these storms can have a devastating, but temporary, impact on traditional occupations. Serious impairment of family life is expected to occur in some individual cases. The incremental contribution to the proposed action (as analyzed for the base case in Section IV.D.1.a(12)) to the cumulative impact level is minimal because there are no expected dramatic short-term increases or decreases in population of the coastal parishes and counties. In addition, minimal net migration into the coastal subareas is expected, and jobs created by the proposed action will reduce out-migration. The extended work schedules and relatively high wages associated with OCS-related employment will cause minor displacement form traditional occupations.

CONCLUSION: Net out-migration is expected to occur, particularly within localized communities that serve as OCS-related staging and administration centering under the cumulative scenario. The loss of wetlands expected under the cumulative scenario is expected to result in deleterious impacts to traditional occupations, cultural heritage, and family life. Deleterious impacts are also expected to occur from tropical storms, relative wages paid to OCS-related personnel, oil and gas development within state waters, and the specialized schedule found in many OCS-related jobs.

(b) Alaska Region

1) Demography and Employment

All cumulative activities and projects described in Section IV.D.1.c are assumed to have associated employment that will increase employment and population in the State as a whole. Except as described below, the cumulative activities and projects will not increase employment and population in remote regional centers in coastal Alaska that may be affected by OCS activity. Cumulative activities located in remote coastal areas near OCS sale areas are assumed to have worker enclaves separated from regional centers with workers commuting out of the area.

Cumulative impacts of Federal oil and gas development in the Beaufort-Chukchi area plus the State governmental activities could substantially increase employment and populations on the North Slope. Anticipated non-OCS activities include possible large-scale onshore natural-gas-development project(s) and are expected to account for about half of the cumulative impacts in the Barrow-North Slope Borough.

Cumulative effects of Federal oil and gas development in the Gulf of Alaska area plus the State-generated activities could substantially increase local employment and population. Work on several projects will be staggered over time, thus spreading out the employment levels.

The primary aspect of the cumulative-case scenario affecting demography and employment is the employment generated by the routine OCS oil and gas activity. The other aspects of the scenario are secondary or not relevant to these resources. In addition to workers employed directly in cumulative-case projects, this anticipated employment would generate secondary employment in other sectors of the economy.

For the cumulative-case scenario, it is assumed for all but one of the six potential sale areas that most of the workers associated with OCS development would work offshore or onshore in worker enclaves separated from the local communities. These workers would commute from their worksites in the remote parts of Alaska to the larger population centers of Alaska such as Anchorage, Palmer, Wasilla, and Kenai-Soldotna, or to locations outside the State. The one area where it is assumed on and offshore workers would not be separated from the local communities would be for the Cook Inlet sale. It is assumed that OCS jobs would be available to the local population in all areas.

It is assumed that employment secondary to OCS employment would be located in local regional centers nearest the sale areas as well as in Anchorage. These regional centers are Barrow for the Beaufort Sea and Chukchi Sea; Unalaska, Cold Bay, St. Paul, and St. George for the Navarin Basin and St. George Basin; the Kenai Peninsula and Kodiak for Cook Inlet; and Cordova and Yakutat for Gulf of Alaska.

Oil spills could occur in any one of the sale areas. It is assumed that most employment associated with oil-spill cleanup would be physically located in locations separated from regional centers, but the actual hiring and population increase would occur in the regional centers. The probability of oil spills occurring for each of the sale areas is described in the scenario.

The assessment of future impacts is based on oil and gas activity affecting coastal communities from 1970 to 1991 described as follows. The largest oil-production activity in Alaska is Prudhoe Bay. Workers at Prudhoe Bay live in enclave housing totally separated from the nearest communities and commute to other parts of Alaska in their offtime. Most live in Southcentral Alaska. Because of this, those working directly in oil production do not impact communities in the NSB. However, Barrow has had substantial secondary employment that has resulted from Prudhoe Bay. A large part of this employment increase is due to the tax revenue available to the NSB and the resulting expenditure of this revenue on NSB capital projects. The NSB would not be able to tax OCS offshore facilities, so this segment of employment and population increase is assumed not to occur for OCS activity. Most workers on oil rigs in Cook Inlet live in the Kenai Peninsula and others parts of Southcentral Alaska and are fully integrated into their communities. Workers at the onshore oil and gas facilities on the Kenai Peninsula reside on the Kenai Peninsula. Nome, Unalaska, and Yakutat have experienced some offshore exploration activity. The workers on the offshore rigs commuted through airports at regional centers to locations mostly outside of the State. About 25 to 100 onshore workers resided in the regional centers in support of the offshore workers for a period of 3 months to 3 years. Had production resulted in these areas, enclaves separate from the regional centers were planned.

Barrow is the regional center that would be affected by the cumulative case with the largest number of production wells assumed in this scenario, 723 for the Arctic subregion as a whole. However, employment and population effects of Prudhoe Bay will be tapering off in the next 10 years and reduce the net increase in population and employment increases generated by the Beaufort and Chukchi Sales.

Navarin Basin and St. George Basin would both impact equally the regional centers of Unalaska, Dutch Harbor, St. George, and St. Paul. The number of production wells in the cumulative case is 300 for Bering subregion, much smaller than for Chukchi Sea alone.

The removal of gravel islands or other permanent production platforms from the OCS will result in negligible effect on demography and employment.

Impacts on demography and employment that are expected to result from the routine aspects of the cumulative case are as follows. Because Barrow is the regional center for both the Beaufort and the Chukchi Sea sales, local employment generated by OCS activity and cumulative activity in the peak years of OCS and cumulative activity is expected to be more than 10 percent but not more than 20 percent of projected employment for more than 5 years, and at least one sector of the local labor force is expected to change by more than 10 percent. In the base case, the increase is expected to be 5 to 10 percent for 2 to 5 years, and no sector of the labor force is expected to change more than 10 percent.

For the Navarin, St. George, and Gulf of Alaska areas, the cumulative impacts on employment and demography is expected to be that local employment generated in regional centers by OCS activity accounts for more than 5 percent but no more than 10 percent of the projected level of employment of the affected area for 5 years, and no sector of the local labor force is expected to change more than 10 percent.

For Cook Inlet, the cumulative effects are expected to be that local employment generated by OCS activity in the peak years of OCS employment accounts for more than 1 percent but no more than 5 percent of the projected level of employment for the affected area for less than 2 years of OCS employment, and no sector of the local labor force is expected to change more than 10 percent.

Population increases are expected to be in the same range as the employment increases for all the local areas as described above. Employment and population increase for the State as a whole is expected to be between 5 and 10 percent for 2 to 5 years with no change in any sector of the state labor force greater than 10 percent. The principal cause of this impact is that employment and population directly in OCS and cumulative activity generates secondary employment on a routine basis.

For each of the six OCS sale areas, an oil spill is expected to generate up to 15 jobs in the closest regional center for up to 1 month. The probabilities of an oil spill occurring are assumed in the scenario to be 20,000 bbl for platform, 25,000 bbl for pipeline, and 30,000 bbl for tanker. Small spills of less than 1,000 bbl are described in the scenario. The size of the population increase is expected to be the same as the employment increase, because it is assumed no families would accompany these workers for such a short period of time.

CONCLUSION: Increased employment is the major impact producing agent in the cumulative case. Under the cumulative scenario for the Beaufort and Chukchi Sea sales, local employment in Barrow is expected to increase 10 to 20 percent for more than 5 years, and at least one sector of the local labor force is expected to change by more than 10 percent. This impact is greater than in the impact for the proposed action, which is that local employment is expected to increase by 5 percent.

For the Navarin, St. George, and Gulf of Alaska sales, local employment in regional centers is expected to increase 5 percent but no more than 10 percent for 2 to 5 years, and no sector of the local labor force is expected to change more than 10 percent. This impact is the same as for the proposed action.

For Cook Inlet, local employment is expected to increase 1 to 5 percent for less than 2 years, and no sector of the local labor force would change more than 10 percent. This impact is the same as for the proposed action.

Population increases are expected to be in the same range as the employment increases for all the local areas as described above. Employment and population increase for the State as a whole are expected to be between 5 and 10 percent for 2 to 5 years with no change in any sector of the State labor force greater than 10 percent. This impact is greater than for the proposed action, which is that employment and population increases for the State as a whole would be between 1 and 5 percent for less than 2 years, with no change in any sector of the State labor force greater than 10 percent. For each of the six OCS sale areas, an oil spill is expected to generate up to 15 jobs in the closest regional center for up to 1 month. This spill impact is the same for the cumulative case and the proposed action. All increases described above are due to the proposal.

2) Land Use

The analysis of the cumulative case of the proposed action is based on the following impact-producing agents (IPA's) and their related infrastructure: offshore and onshore minerals mining, commercial fisheries and related infrastructure, Native corporation oil and gas lease sales, State oil and gas lease sales, and onshore and offshore Federal oil and gas lease sales.

Offshore and onshore mining along coastal Alaska will result in the construction of a transportation infrastructure that may be of benefit to the oil and gas industry. Gold- dredging operations in the Norton Sound off of Nome have led to port improvements, while the opening of the Red Dog Mine in northwest Alaska included the construction of a barge dock north of the Chukchi Sea community of Kotzebue. The growth of commercial fisheries in the Bering Sea has sparked the construction of a small boat harbor on St. George Island and the desire to build a similar facility on the neighboring island of St. Paul. The Aleutian fishing community of Unalaska has undergone an extensive expansion of its port facilities to meet the needs of the Bering Sea fishing fleet. Proposed OCS lease sales and development from existing OCS leases all will have effects on infrastructure and its effects on land use. In addition to Federal OCS sales, the 1990's will witness additional port and infrastructure growth due to Native corporation and State oil and gas lease sales. Pipeline and roads entering previously uninhabited areas will create new categories of land use for much of northern Alaska. Please refer to Section IV for the scope of effects of the proposed action and Section IV.D.1.a for an analysis of the proposal.

The effect of the aforementioned IPA's will be: (1) increased infrastructure available to the oil and gas industry for offshore operations and (2) changed land use categories throughout coastal Alaska and across the central North Slope. Other than on the North Slope, the proliferation of roads, ports, and storage facilities and other forms of infrastructure that would benefit oil and gas exploration would tend to moderate effects of the infrastructure related to the proposal on Alaska's land use patterns. However, the proposal would result in the construction of a pipeline from the Chukchi Sea coast to the TAPS/with connection(s) from the Beaufort Sea coast), an aggregate distance of 600 mi or more, through largely uninhabited lands that are currently used primarily for subsistence hunting. This would constitute the largest Alaskan construction project since the building of TAPS and, in terms of infrastructure effects, would constitute a major portion of the total cumulative effects.

As mentioned in the previous subsection on infrastructure, the IPA's will cause the expansion and maintenance of existing port facilities as well as the construction of new dock facilities. Oil and gas exploration firms may be able to use these facilities with some additions to satisfy bulk-storage requirements. The proposal by itself would require the construction of two dock facilities for supply operations at Point Belcher (northwest Alaska) and the west shore of Kodiak island.

CONCLUSION: The proposal based on the effect of a Chukchi Sea—TAPS pipeline alone would engender at least half of the total cumulative effects considered in this section. The northern Alaska pipeline projects would alter the land use patterns along their 600-mi route

3) Transportation Networks

The cumulative case of the proposed action will be affected by the following impact-producing agents (IPA's) and their related infrastructure: offshore and onshore minerals mining, commercial fisheries and related infrastructure, Native corporation oil and gas lease sales, State oil and gas lease sales, and onshore and offshore Federal and State oil and gas lease sales.

Due to its geography, size, and lack of surface transportation, State of Alaska passenger and light cargo-transportation requirements are primarily met by air carriers. All of the IPA's listed would have direct and indirect effects on all of Alaska's principal air routes and air-terminal facilities. The IPA's could cause the expansion of some existing air facilities, and the possible construction of new facilities in interior Alaska. The proposal would result in the establishment of two new air facilities, one at Point Belcher the other on Kodiak Island. Both airfields would be established near pipeline landfalls. The proposal also would cause the expansion of some smaller fields that serve Bering and Chukchi Sea communities. Overall, however, the proposal would provide 20 to 30 percent of the anticipated cumulative effects.

Further development of Alaska's commercial fisheries, hard-rock mining, and petroleum-resource potential will generate additional large-vessel traffic (ore carriers, etc.) and stimulate the construction of new ports and the expansion of existing port facilities. Alaska has rich deep-sea-fishery resources and a growing deep-sea commercial-fishing industry. This phenomenon is most evident in the Bering Sea fishery. The Port of Unalaska on the Aleutian Chain has expanded rapidly over the last decade to meet the needs of the deep-sea fishing fleet. Indeed, the port shows every indication of continuing its expansion. The Bering Sea islands of St. Paul and St. George have upgraded their harbor facilities to capture some of the activities of the Bering Sea commercial-fishing fleet. Future hard-rock-mineral production may cause the creation of new dock facilities in western and southeastern Alaska.

Continued mining operations in northwest Alaska in the vicinity of the Red Dog Mine will probably cause the expansion of that port facility. On the Seward Peninsula, the continuing expansion of the Port of Nome will be a foreseeable response to large-scale mineral development in that region. In southeastern Alaska, gold and precious-metals mining is on the increase. The development of the huge Quartz Hill molybdenum mine near Ketchikan is on hold pending more favorable metal prices and the resolution of certain environmental issues. Future non-OCS oil and gas production in central and northern Alaska most likely will be tied into TAPS. This will affect the level of tanker traffic issuing from Valdez in that the added flow of oil from State leases will slow its decline. Overall, the proposal is expected to comprise at least 30 percent of the total traffic attributable to the marine transportation arising from the anticipated cumulative case.

The various IPA's will cause the construction of several rural mining and feeder roads. Many of these roads will be of dirt construction, linking mining activities with a transit point (a port, an airfield, or one of Alaska's highways). These roads will be of rough construction, engineered for truck and other work-related vehicles. If the mining roads do connect to a highway, eventually some of them may be paved or graveled. Such upgrading would occur should the roads prove of value to the tourism industry or engender the construction of homesites (land use regulations permitting). In other areas of Alaska, the IPA's may well cause truck and large-vehicle traffic to exceed the load-bearing capacity of some highways inducing their premature degradation and causing a premature expenditure of State revenues for maintenance. The aggregate of these IPA's over time will have a significant cumulative effect on the surface-transportation systems of Alaska; however, of all the projects analyzed, the proposal will have the largest single effect—as much as 40 percent of all cumulative effects. This percentage is primarily due to the forecast construction of a pipeline and associated road from the Chukchi Sea to the TAPS. The road and pipeline would be the largest construction project undertaken in Alaska since the construction of TAPS.

CONCLUSION: Transportation networks in the cumulative case are impacted by offshore and onshore minerals mining and oil and gas lease sales, commercial fisheries, tourism, and homesteading (land use regulations permitting). It is anticipated that all IPA's will contribute to a transportation network increase of 40 percent over the life of the proposal. The effect of the proposal, when weighed against the cumulative IPA's, is expected to constitute 15 to 20 percent of total transportation effects as described above.

4) Sociocultural Systems

The IPA's that could affect the sociocultural systems of Alaskan communities in the cumulative case include existing oil and gas infrastructure on the North Slope and in Cook Inlet; State of Alaska and private (largely Alaskan Native regional corporation) oil and gas lease sales; Canadian offshore and onshore oil and gas lease sales; the transportation of oil and gas by means of tankers and pipelines; offshore and onshore nonenergy minerals leasing activities, such as the Red Dog Mine and gold dredging; coastal development and habitat loss or contamination; commercial fishing; and existing and proposed Federal offshore and onshore lease sales. The probability of any or all of the ongoing and planned offshore and onshore oil and gas projects reaching the development and production stage is unknown; however, the following discussion assumes that all of these projects would reach the development and production stage. The effects of these projects on sociocultural systems may occur because of the introduction of changes in industrial activities, changes in local population and employment, and effects on community subsistence harvests and networks.

The changes in industrial activities introduced by the cited IPA's would be community-specific and, in most cases, would not represent the introduction of industrial activities for the first time. Most supply and support bases would be located at or near existing industrial infrastructure, such as airports and harbors. Communities such as Unalaska, Yakutat, and St. Paul have decommissioned support bases already in existence that could be re-activated. Changes in the number and characteristics of population and employment associated with industrial growth likewise would be community specific. In communities oriented toward commercial fisheries, such as Unalaska and St. Paul or St. George, the introduction of OCS-related population and employment would disrupt the overall social organization and value-orientation of the community, but it is likely that such changes would not change the major social institutions of the communities. Linked with increased commercial fishing activities, especially in the Bering Sea, such increased levels of economic activity may be recognized locally as a positive way of stabilizing employment variability locally.

Impacts on subsistence are probably the most powerful means for insulting existing social systems in Alaska and causing impacts on sociocultural systems within specific and regional communities. The analysis of cumulative impacts on subsistence (Section IV.D.1.c(12)) indicates that the cited IPA's would produce the most severe impacts among North Slope communities, and that the proposal would be a major contributor to such impacts given that half the proposed lease sales in the proposal are assigned to the Beaufort and Chukchi Seas. Chronic, multiyear disruptions of subsistence harvests would affect subsistence task groups, have a tendency to displace sharing networks, and consequently cause a decrease in the importance of subsistence as a highly valued cultural activity.

North Slope communities already are experiencing problems in the social health and well-being of their communities. Increased industrialization of the region (including offshore oil development as an IPA) would lead to further disruptions of their social health and well-being. Increased rates and duration of dysfunctional behavior, such as substance abuse, domestic violence, wife and child abuse, rape, homicide, and suicide, would be indicators of such disruptions.

Further effects from the industrialization of the Arctic would accrue to communities in southcentral Alaska as a result of tankering Arctic oil from the southern terminus of the TAPS at the Port of Valdez. The *Exxon Valdez* oil spill demonstrated that social effects would linger for quite a few years, especially within the more subsistence-oriented Native communities .

CONCLUSION: Effects on subsistence are a significant factor for causing social disruption and fragmentation in Alaskan Native communities. The analysis of cumulative impacts on subsistence (Section IV.D.1.c(12)) indicates that the cited IPA's would produce the most severe impacts among North Slope communities, and that the proposal could be the major contributor to such impacts given that half the proposed lease sales in the proposal are assigned to the Beaufort and Chukchi Seas. North Slope communities already are experiencing problems in the social health and well-being of their communities. Increased industrialization of the region (including offshore oil development as an IPA) would lead to further disruptions of their social health and well-being. Social effects of Arctic industrialization also would be transferred to southcentral Alaska through effects on subsistence from the tankering of Arctic oil from the Port of Valdez. In communities oriented toward commercial fisheries, such as Unalaska and St. Paul or St. George, the introduction of OCS-related population and employment would cause a rupture in the overall social organization and value-orientations of the community, but it is likely that such changes would not change the major social institutions of the communities. Impacts on sociocultural systems in the cumulative case would be primarily focused on Arctic communities because of effects on subsistence caused by Arctic oil and gas production. These are due to the proposal. Effects of Arctic industrialization secondarily would be felt within communities in southcentral Alaska because of the tankering of Arctic oil from the Port of Valdez. Approximately 10 percent of the oil through TAPS is estimated as due to the proposal. The social systems of Bering Sea communities also would be affected by industrialization, but not to the extent of possible social disruption elsewhere, and the effects of the proposal are not measurable in this area.

(c) Pacific Region

1) Demography and Employment

Without the proposal, employment and population are expected to increase in the Pacific Region due to general population and economic growth in the regional area. Other activities and/or projects (excluding the proposed action) likely to contribute to employment and population growth include oil and gas exploration and development activities in State and Federal waters, the removal of abandoned offshore structures, and the expansion of the Los Angeles Harbor.

The projected employment and population increases without the proposal (baseline projections) are discussed in Section IV.D.1.a for the years 1990 to 2030. These projections are assumed to account for the potential growth activities, such as a regional expansion in most economic sectors, including ongoing and future oil and gas exploration and development activities planned for existing leases in State and Federal waters, residential and commercial construction, expansion of marine transportation through the Ports of Los Angeles and Long Beach, San Diego, and the other ports and harbors serving the southern California area, and the construction of new community infrastructure or the expansion/upgrading of existing community infrastructure throughout the region. Therefore, no separate employment and population estimates were prepared for the analysis presented here, even though these types of projects have also been identified and described under Cumulative Projects.

Throughout the next 40 years (1990-2030), employment and population associated with ongoing economic growth and non-OCS projects are estimated to increase about 2 percent per year in the counties adjacent to the Santa Maria and Santa Barbara Channel areas. OCS oil and gas activities associated with the base-case scenario would cause very low impacts (less than one percent over the life of the proposal) to employment and population in the Santa Barbara and Santa Maria areas. Therefore, impacts to both employment and population from the proposal would be much lower than impacts associated with ongoing growth and other projects in the area.

CONCLUSION: Cumulative employment increases in the southern California area attributable to non-OCS activities are estimated to be about 2.5 percent of the baseline per year. Cumulative population increases in the southern California area are estimated to be about 2.5 percent of the baseline per year. The incremental effect of the proposal will not change the expected effects associated with the general economic and population growth in the Region.

2) Land Use

Factors that may produce cumulative effects on land use include both non-OCS and OCS-related activities. A major source of non-OCS impact to land use is general population increases in all regions. Population growth would continue the pressure to convert non-urban land uses to urban uses. The Ports of Los Angeles/Long Beach 2020 Master Plan calls for extensive dredging and filling to create an additional 2,400 to 2,800 acres of land, and the change in use for over 1,400 additional acres on the port area. This could have a high impact on land use in the Los Angeles/Long Beach harbor.

Oil and gas activities from existing leases and any new leases could have a minor impact on land use as the onshore facilities are already existing or have been permitted. No new onshore facilities are expected to be constructed to accommodate hydrocarbons produced from blocks included on the proposed leasing schedule. Newly discovered oil and gas resources will be processed at existing or currently planned facilities that will remain in place on appropriately zoned land throughout the project life of the proposed leasing schedule. The proposal would not add significantly to that pressure, since population increase from the proposal would only result in demand for housing of less than one percent.

CONCLUSION: The cumulative effect of these stresses is expected to have low impact on land use in the southern California area with localized high impacts in the Los Angeles/Long Beach harbor area. The proposal is expected to add a very small amount of impact to coastal land use.

3) Vessel Traffic and Ports

Marine vessel traffic could be impacted from other activities and projects which are listed in Section IV.D.1.c.

Oil and gas activities from past lease sales, Alaskan and foreign import tankering, expansion of the Ports of Los Angeles/Long Beach, and coastal development in California, are expected to have a low impact on marine vessel traffic due to the number of vessels which would be added to the traffic flow in southern California. The proposal is assumed to displace an equal amount of imported oil. Therefore, the proposed action will slightly reduce the number of import oil tanker trips into the Ports of Los Angeles and Long Beach.

The cumulative case assumes that there would be a large pipeline oil spill (about 7,000 bbl.), and one platform oil spill (about 20,000 bbl.) from southern California oil and gas activities. The scenario also assumes that five tanker oil spills (about 30,000 bbl each) would occur along the tanker route due to Alaska OCS oil production. Of these five tanker spills, two are assumed to occur more than 50 miles offshore the coasts of Oregon and northern California. The other three tanker spills are assumed to occur within fifty miles off the coasts of Washington, central California, and southern California.

The cumulative scenario also assumes that there would be another five tanker spills from TAPS. These are non-OCS related oil spills. Two of these spills are assumed to occur within fifty miles off the coast of Washington, one spill within fifty miles off the coast of central California, and two spills within fifty miles off the coast of southern California. The cumulative-case scenario also assumes that there would be five tanker oil spills from foreign imports. One of these spills would occur within fifty miles off the coast of Washington, one spill would occur within fifty miles off the coast of central California, and three spills within fifty miles off the coast of southern California. The probability of a spill greater than 1,000 bbl is 87 percent. It is likely that some of these spills would contact the shipping lanes, resulting in the rerouting of vessels around the spills for the duration of cleanup activities offshore (which could take as long as two months).

The Ports of Los Angeles and Long Beach 2020 Master Plan will expand the capacity of the Los Angeles/Long Beach Harbors. This will reduce the potential conflicts for docking space within the harbor complex when completed. However, it will cause impacts to shipping approaching or departing Los Angeles/Long Beach harbors due to the increased potential for collisions.

CONCLUSION: Expansion of the Ports of Los Angeles/Long Beach, increased foreign import tankering, and continued development of the California coast are the primary factors affecting marine vessel traffic. The proposal is expected to add two supply boat trips per week per well during exploration and development, and one trip per week per platform during production. The proposal is also expected to add two crew boat trips per day to marine vessel traffic in southern California. Drilling vessels and platforms hypothesized for the proposal will be placed well outside of established vessel traffic lanes and will not impede vessel movement. Overall, routine and accidental OCS events are not expected to impact vessel traffic or ports.

4) Public Services

Whether or not the proposal occurs, water supplies would continue to be impacted. The impacts to water supply from cumulative projects including existing State and Federal oil and gas leases may be very high in the southern California area. In addition, population is expected to grow at an average annual rate of two percent. All this growth could cause increased overdrafting of water supplies from the local groundwater basins.

The impact from existing and future development in the Santa Barbara Channel and Santa Maria basin counties could result in long-term stress on existing supplies or services requiring facility construction, expansion or new sources of water. Expected development from the proposal would add a small increment to the overall impact. The incremental impact to water supply from the proposal, when considering all other development, would be of a minor nature. Larger sources of impacts would be from population growth associated with general development.

Cumulative impacts to water supply would come from non-OCS related activities including general population growth and non-OCS industry. These impacts would put a lot of stress on water supplies, requiring facility expansion or new sources of water. This impact would result from the continued increasing demand for water and wastewater treatment capacity while water supply sources are diminishing and existing facility capacity is being reached and exceeded. A conservation program and management of groundwater basins may reduce the severity of impact or prolong the time before severe impacts occur. Local jurisdictions will have to make decisions regarding capital improvements to existing wastewater treatment facilities and long-term management of groundwater basins. The primary impacting agent will be general population growth and will happen in all counties of southern California.

The City of Santa Barbara has started construction for the installation of a temporary desalination plant to provide additional water supply for the communities of Santa Barbara, Goleta, and Montecito. The plant will produce 7,500 acre-feet per year (AFY) of potable water, with an expansion capability of up to 10,000 AFY. The facility is being built on 1.8 acres of land and has been permitted as a temporary five-year drought response project. At the end of five years, the City may require removal of the facility, purchase the facility, or extend the contract with Ionics, Inc., the company that owns and operates the facility. Reverse osmosis will be used in which seawater will be desalted and resulting potable water distributed via existing water systems. Water delivery is expected to begin in February 1992. An oil spill would make the desalination plant inoperable if the intake area were affected.

CONCLUSION: The overall cumulative impact to the Southern California water supply, when considering all other projects and general population growth, is expected to cause severe stress to water supply. Hypothesized OCS activities will contribute to that stress but this contribution is very small compared to the impact of continued population increase.

(d) Atlantic Region

1) Demography and Employment

The existence of several metropolis' and commercial ports combined with historic trading patterns makes international commerce a major industry along the eastern seaboard. This fuels industrial growth in areas such as petroleum mineral processing, coal and chemical production, manufacture of fertilizers, machinery, building materials, textiles, and wood products, banking and finance, food production and distribution. The waters offshore the Atlantic coast also sustain a major commercial fishery. This industry provides a livelihood for thousands of area residents (see Section III.D.3.b).

Additionally, because of its historic sites and many natural areas, the Atlantic coast has a thriving coastal recreation and tourism industry. This industry attracts visitors from other Atlantic States, the Midwest, and Europe (see Section III.D.3). Section III.D.3.a(1) contains a description of the employment and demographic characteristics of the Atlantic States.

Non-OCS related activity combines to fuel vigorous growth in the eastern seaboard's population and employment. Population has increased in the coastal counties of the Atlantic States since 1960. Census Bureau projections show an increasing population in the area through the 1990's and beyond the year 2000. The projected increases in population are expected to be primarily the result of non-OCS development.

A comparison of the cumulative case with the proposed action results in assuming that OCS development will need an additional 15 exploration wells, 52 development and production wells, 3 production platforms, gas pipeline, and gas processing plant [see IV.D.1.a(10)].

The increased drilling activity is assumed to occur over the same period as the proposed action. As a consequence, 1 or 2 additional drilling rigs will be needed for the exploration, development, and production program (see Section IV.D.1.a(10)). As stated in the base-case analysis, the absence of an offshore drilling industry in the Atlantic coastal States is expected to necessitate importing the personnel needed for drilling operations. Only if there is a non-drilling related vacancy (i.e. floorman, painter, welder, roustabout), would offshore operators hire qualified local personnel. Therefore, the number of primary employment opportunities created by the cumulative case drilling program is not expected to increase significantly over the base case. Since exploration drilling is typically a short term and temporary activity, the revenue increase from the assumed increase in exploratory activity is not expected to be permanent (see Section IV.D.1.a(10)). As a result, increases in onshore expenditures related to exploration programs are not expected to create secondary employment opportunities in the area.

As with the exploration phase, hiring of offshore drilling crews and onshore support personnel for a development and production program, including the construction of an additional gas pipeline, is expected to occur outside the Atlantic coastal region. Again, this is expected to result in few jobs being available to local residents. Because of the longer period of drilling activity, secondary employment is expected to increase as a result of increases in revenue from spending by offshore personnel on supplies, and housing. The construction of the assumed gas processing facilities is expected to employ some local people. The size of the facility is expected to determine the amount of employment opportunities. The construction period, which also depends on the size of the processing facility, can range from 1 to 1.5 years. Therefore, any jobs created by construction of the plant are not expected to be permanent.

Because of steady, long-term employment prospects provided by development and production of OCS resources, oil field workers may decide to settle in the area. Under the cumulative-case scenario, assumed development activities are expected to result in the increase of several hundred more people than is expected for the base-case scenario of the proposal in areas relatively close to the permanent support bases (see Section IV.D.1.a(10)).

Impacts in the cumulative case are expected to result from the tankering of imported oil into the area from outside the Atlantic OCS. Depending on the extent of coastal contact of the spilled oil, hiring of local people can occur to help remove oil from contaminated coastal resources. This increase in employment is expected to be temporary and gradually decrease as oil is removed from affected areas.

In summary, because of the short-term nature of exploratory activities, few employment opportunities are expected from the assumed drilling program for coastal residents. Because of their longer period of operation, development and production of discovered resources is expected to increase employment in areas surrounding permanent support bases. However, this increase is not expected to add significantly to the existing economy. This is because population growth from non-

OCS activities in the Atlantic States are orders of magnitude larger than the potential contributions from OCS development (Section III.D.3.a).

CONCLUSION: Under the cumulative scenario for the proposed action, the absence of an offshore drilling industry limits OCS-related employment opportunities for local residents. However, large increases in the size of the population and job opportunities are expected from other non-OCS development.

2) Land Use

The coastal areas of the eastern seaboard are dominated by many estuarine drainage areas. Wetland environments are the major land type throughout the coastal zone of the Atlantic States. The existence of the northeastern megalopolis exerts strong pressure on land use along the Atlantic coast. Outside of this urbanized region, development pressures are focused around major commercial ports and coastal recreation and tourism sites in the region. The conversion from wetland to urban or industrial land is significant because industrial, commercial, residential, and municipal activities are major sources of pollutants into estuarine waters. Additionally, with a growing population and increased development, there also is an increasing demand for more estuary-based public recreation facilities and services.

As stated in the cumulative-case analysis of impact on population and demography (Section IV.D.1.c(10)), the area's population is expected to continue increasing through the 1990's and beyond the year 2000. This increase in population is expected to increase the amount of commercial, residential, and industrial development in the area. This increase in development is expected to occur in all States and produce tremendous pressure on the coastal environment. Population increases associated with this non-OCS related development are orders of magnitude larger than those from assumed OCS operations. Consequently, the amount of acreage subject to land use impacts will be correspondingly greater from non-OCS related development.

OCS development assumed to occur in the cumulative case can create pressures on coastal resources through the building of onshore facilities associated with the proposed action. When compared to the proposed action, the number of wells drilled is assumed to increase, resulting in hydrocarbon production requiring 3 additional production platforms for a total of 9. The number of support bases assumed to resupply these facilities are expected to remain the same, however. Therefore, impacts produced by resupply efforts for offshore facilities are expected to be identical to those discussed for the proposed action (see Section IV.A). Consequently, no impact on coastal land use is expected from the support bases assumed under the cumulative-case scenario.

OCS development assumed to occur in the cumulative case will require an additional gas pipeline (4 total) and gas processing plant (2 total). Construction of the additional gas pipeline and gas processing facility assumed in the cumulative-case scenario are expected to move undeveloped land into the industrial class of land use. This is expected to be a permanent change. However, as with the pipelines and gas processing plants assumed for the proposed action, Federal, State, and local regulations are expected to ensure that the additional gas pipeline landfall and processing facility in the cumulative-case scenario will be sited in areas already designated for industrial development (see Section IV.D.1.c). Therefore, no impacts on coastal land use from OCS development are expected.

In the cumulative-case scenario, 13 oil spills greater than or equal to 1,000 bbl are assumed to occur from the tankering of imported oil. The potential impact to coastal land use, should these spills reach land, is a possible change in management guidelines for coastal areas. This need for changes in land management priorities will depend on the severity of the environmental damage to the affected areas and the success of cleanup efforts.

In summary, as discussed under the base case, existing ports in the region are expected to have the acreage needed for OCS support bases. Discernible impacts on coastal land use are thereby avoided. Additionally, State coastal management programs and other Governmental requirements are expected to direct pipeline landfalls and development of gas processing facilities to appropriate areas. Large accidental releases of oil into the coastal environment could force changes in coastal land use. Non-OCS activities are expected to generate greater pressures on the coastal environment than OCS related development.

CONCLUSION: There is expected to be an increase from the existing acreage of industrial/urban class of land because of increased development in the cumulative case. OCS development is not expected to contribute substantively to this increase.

3) Vessel Traffic and Ports

The existence of several metropolis' and commercial ports combined with historic trading patterns makes international commerce a major industry along the eastern seaboard. The amount of freight handled at commercial ports in the region has grown throughout the 1980's. The controlling authorities have invested millions of dollars in new loading and shipping technology in anticipation of continuing growth in the industry. Consequently, there is expected to be substantial growth in the volume of commercial vessel traffic offshore the Atlantic States. Section III.D.a contains a description of marine vessel activity at Atlantic coast commercial ports. In addition to the growth in cargo transfer, the waters offshore the Atlantic coast also sustain a major commercial and recreational fishery. These industries provide a livelihood for thousands of area residents (see Section III.D.3.b). This fishery-based vessel traffic contributes to the overall volume of traffic that must be monitored by marine law enforcement authorities and local port authorities.

As the population of the area grows, the need for the commodities that are brought into the area's commercial ports will continue to increase. Growth in the amount of tonnage handled is expected to increase. As long as the commercial fishery is healthy, this increased demand is expected to promote the growth of the industry. While the commercial fishing industry uses the major commercial ports of the region, it also uses many of the area's smaller ports. Therefore, a growing population is expected to contribute to an increase in the volume of marine vessel traffic at both small and large ports throughout the Atlantic States.

Resupply vessel activity for assumed offshore drilling facilities are expected to create a potential for impact on marine vessel traffic. Although the number of support bases assumed for the cumulative case remains the same as for the base case, the size of the support bases and the amount of vessel activity depends on the number and kinds of drilling rigs served. Consequently, since the number of wells assumed to be drilled in the cumulative case (210) is greater than in the base case (143), vessel activity is expected to increase over base case levels. To minimize the potential for OCS operations to interfere with marine vessel traffic, Federal authorities prohibit the siting of offshore structures in official traffic routing schemes and promote informational programs designed to ensure that OCS personnel can recognize commercial and recreational vessels and their gear. Therefore, under the cumulative scenario, impacts are not expected to increase over those expected for the base case.

Because of the assumed increase in marine vessel activity, the potential for small fuel spills will increase beyond that assumed for the proposed action. The U.S. Coast Guard minimizes the potential occurrence of these small spills by enforcing marine safety laws within ports and determining the seaworthiness of marine vessels. Additionally, Federal regulations require operators to prepare oil spill contingency plans (see Appendix D). Therefore, impacts are not expected to increase over those expected for the base case.

Under the cumulative-case scenario, 13 oil spills greater than or equal to 1,000 bbl are assumed to occur from the tankering of imported oil. Oil spills this size have the potential to affect vessel traffic patterns and change schedules. Maintaining normal volumes of vessel traffic in the area of the spill could interfere with oil spill containment and cleanup efforts. Oil in the water can also foul boats and their machinery. Consequently, delays or no wake restrictions are expected for vessels traveling through the affected area. However, these restrictions will only be in effect until cleanup activities are completed.

In summary, as discussed in the base case, existing traffic routing measures and safety regulations are expected to manage the increases in vessel traffic that will occur from the assumed increases in drilling activity under the cumulative case. Enforcement of marine safety laws and oil spill contingency plans are expected to combine to prevent appreciable impacts from small fuel spills. Traffic restrictions caused by the assumed oil spills are expected to last until potential damage to the environment from the resumption of normal traffic volumes is eliminated.

CONCLUSION: Existing ports are expected to handle the expected increases in vessel traffic from assumed OCS operations. However, non-OCS activities considered for the cumulative case are expected to cause increases in marine vessel traffic at small and large ports throughout the Atlantic States. Non-OCS activities are expected to require modification of some port facilities to accommodate the increased vessel traffic.

(11) Impacts on Fisheries

(a) Gulf of Mexico Region

1) Commercial Fishing

This cumulative analysis considers the present status of commercial fisheries stocks, commercial fishing practices, the effects of impact-producing factors related to State oil and gas activity; crude oil imports by tanker; and the proposed action, prior and future OCS sales that may occur and adversely affect commercial fisheries. These impact-producing factors and their effects are discussed in detail in Section IV.A.

Competition between large numbers of commercial fishermen, between commercial operations employing different fishing methods, and between commercial and recreational fishermen for a given fishery resource may reduce standing stocks of commercial fisheries. Fishing techniques such as trawling, gill netting, or purse seining, when practiced nonselectively, may reduce the standing stocks of the desired target species as well as significantly impact species other than the target. Space-use conflicts can result from different forms of commercial operations and between commercial and recreational fisheries. The availability and price of key supplies and services such as fuel can also affect commercial fishing operations in the Gulf of Mexico.

The majority of commercial species harvested from the Gulf of Mexico are believed to be in serious decline from overfishing. Continued fishing at the present levels may result in rapid declines in commercial landings and eventual failure of certain fisheries. Commercial landings of traditional fisheries, such as shrimp and red snapper have declined over the past decade despite increases in fishing effort. Commercial landings of recent fisheries, such as shark, black drum, and tuna have increased exponentially over the past five years, and those fisheries are thought to be in danger of collapse (Angelovic, written comm., 1989; USDOC, NMFS, 1989a). It is expected that overfishing of targeted fish resources and trawl fishery bycatch will cause a one to five percent economic loss to commercial fishing within the Gulf of Mexico. Should overfishing cease, commercial fisheries would economically stabilize (not increase) within two to three generations of the affected fish resources.

Comprehensive information on oil and gas activities in State waters in the Gulf of Mexico region has not been compiled. Many oil and gas activities carried out in State waters prior to the 1950's were neither documented nor permitted in the way they are now, and information is scarce or lacking. A number of activities associated with State oil and gas operations could impact the commercial fishing industry in the Gulf of Mexico. These would include routine operational discharges and accidental spills; refining and processing activities; support vessel traffic; pipeline activities; coastal geophysical and platform removal activities using explosives; site clearance activities; and transport, storage, and disposal of oilfield wastes. The effects on the commercial fishing industry would be similar to those discussed in the base case.

Allowing for the setting and raising of trawl fishing nets as well as for the actual on-bottom fishing, the emplacement of a production platform, with a surrounding 500-ft navigational safety zone, results in the loss of approximately six hectares (15 ac) of trawling area to commercial fishermen and causes space-use conflicts (Brashier, 1988; Natural Resources Consultants, Inc., 1990). Space-use conflicts occur when more than one resource user is eliminated from an area on the OCS (Centaur Associates, Inc., 1980). It is estimated that 518 offshore platforms or structures will be installed as a result of the proposed action. It is estimated that installation of these structures will remove approximately 3,100 ha (7,700 ac) of trawling space from commercial fishing and that this represents a loss of less than 0.01 of trawling area available to Gulf of Mexico commercial fishing.

It is assumed that a particularly favored trawling spot for shrimp or sciaenid ground fish may be occupied by a platform as a result of the proposal. However, due to the dispersed nature and season movement of shrimp and commercial fishing practices in the Gulf of Mexico (see Sections III.A.2.d and III.A.3.b.1 for further details) it is likely that commercial fishermen will at most be inconvenienced by a newly installed platform and trawl nearby. This inconvenience will cause an initial increase of less than 0.01 percent in fishing effort and expenditure of materials while commercial fishermen become more familiar with nearby areas. It is expected that platform emplacement will cause a 0.01 percent to 0.1 percent economic loss to commercial fishing for shrimp or sciaenid ground fish for no more than one fishing season within 3,100 ha of the Gulf of Mexico.

Underwater OCS obstructions such as nearshore pipelines and offshore OCS-related debris cause gear conflicts with commercial fishing for shrimp, menhaden and sciaenid ground fish. Gear conflicts result in such losses as trawls, catch, business downtime, and vessel damage. It is estimated that about 9,000 km (14,400 miles) of pipeline will result from the proposed action. Effective November 1989, Public Law 101.599 required that by May, 1991, all OCS nearshore pipelines (those pipelines that traverse State waters) in the Gulf of Mexico be examined to ascertain if they presented an underwater obstruction to commercial fishing and if so the law required immediate rectification by burial. By November 1993, the USDOT must establish a permanent inspection program to ensure that OCS pipelines do not present underwater obstructions to nearshore commercial fishing activities. Based on examination of Congressional subcommittee discussion concerning the law, it is assumed that the inspection program will require complete pipeline examination and rectification every three years. For nearshore harvesting of shrimp and menhaden, the enactment of this law greatly reduces if not eliminates future gear conflicts between OCS and nearshore commercial fishing activities.

Most financial losses due to gear conflicts that occur in waters farther offshore from bottom trawling for species such as brown shrimp and sciaenids are covered by the Fishermen's Contingency Fund (FCF). Although Gulf fishermen are absorbing some economic loss from this impact producing factor, the economic loss ($504 million) for any fiscal year (1990) continues to be less than 0.01 percent of the value ($700 million) of that same fiscal year's (1990) commercial fisheries landings. It is expected that underwater obstructions will cause a 0.01 percent to 0.1 percent economic loss to commercial fishing of menhaden, shrimp, and sciaenids for no more than one fishing season.

Oil spills resulting from the OCS program and import tankering have been described earlier under Gulf of Mexico Marine Mammals (Section IV.D.1.c(3)). That description includes assumptions of oil spill occurrence, spill sizes, and likely contacts with shoreline and wetlands areas.

It is assumed that there will be contact between commercial fishing and spilled oil as a result of the proposed action. Both lethal and sublethal effects on commercial fisheries resources are expected. The extent and severity of effects on adult finfish resources will be limited and lessened due to some capability to actively avoid an oil spill, and to metabolize hydrocarbons and to excrete both metabolites and parent compounds from their gills and liver. Commercial fishing in the Gulf of Mexico relies upon the harvest of estuary-dependent species. The effects from an oil spill contacting a Gulf estuary would adversely affect commercial fishing for such species as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters that use that area as a nursery and/or spawning ground.

The fishermen tend to fish within a limited, traditional area. Due to the Gulf's reliance upon estuary-dependent species and their life histories, traditional fishing areas may be just a few hours from port. Fishermen are reluctant and often unable to switch gear type or to change target species. It is assumed that within 25 km^2 surrounding the area contacted and affected by a oil spill and that within 5 km^2 surrounding the area contacted and affected by a small oil spill, commercial fishing activities will be depressed. It is expected that oil spills will cause a one to five percent economic loss to commercial fishing for two to three fishing seasons.

In summary, a number of activities such as commercial fishing practices, overfishing, production platform emplacement, and oil spills may adversely affect commercial fisheries in the Gulf of Mexico. It is expected that overfishing of targeted fish resources and trawl fishery bycatch will cause a one to five percent economic loss to commercial fishing within the Gulf of Mexico. It is expected that platform emplacement will cause a 0.01 percent to 0.1 percent economic loss to commercial fishing for shrimp or sciaenid ground fish for no more than one fishing season within 3,100 ha of the Gulf of Mexico. It is expected that underwater obstructions will cause a 0.01 percent to 0.1 percent economic loss to commercial fishing of menhaden, shrimp, and sciaenids. It is expected that oil spills will cause a one to five percent economic loss to commercial fishing.

CONCLUSION: Under the cumulative scenario it is expected that there will be a one to five percent economic loss to Gulf of Mexico commercial fisheries of estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters for two to three fishing seasons. Commercial fisheries will recover from the affects of oil spills within two to three fishing seasons. Overfishing is considered the most damaging to Gulf of Mexico commercial fisheries. The incremental contribution of the proposed action (as analyzed in Section IV.D.1.a(11)) to the cumulative impact is negligible because it is expected that from the proposed action there would be a 0.01 to 0.1 percent economic loss to commercial fisheries of estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters for one to two fishing seasons (1-2 years).

2) Recreational Fishing

Cumulative impacts on the recreational fishing industry include those impacts related to major non-OCS impact producing factors and the impact of the proposed action, prior, and future OCS sales. Significant and persistent impacts on sport fishing activities will affect the marine recreational fishing industry. Production platforms and major pollution incidences are impacting factors related to the proposal most likely to have some influence on the recreational fishing industry in the Gulf of Mexico region over the next 45 years.

The marine recreational fishing industry in the Gulf of Mexico will be affected by activities and events other than the oil and gas industry. General economic activity in the region along with a viable fishery for target species will ultimately influence the recreational fishing industry. Competition between commercial and recreational fishermen and among recreational fishermen for the same resource; effects from natural phenomena such as extreme freezes and hurricanes on fish resources; and pollution and coastal modifications affecting wetlands or fish nursery areas can significantly affect the resource base to the point that it will be detectable at the industry level regionally. Pollution and coastal modifications associated with general economic development and coastal population expansion can contribute to a decline in the productivity of marine ecosystems throughout the Gulf and will ultimately effect the productivity of recreational fishing, but is unlikely to affect the general level of fishing activity.

In addition to the 168 platforms projected for installation in the Gulf of Mexico from the proposed action, another 518 are expected to result from lease sales held in the recent past. A total of 3,760 platforms currently exist in Federal waters of the Gulf of Mexico and most of these are off the coasts of Louisiana and Texas. These structures function as artificial reefs and attract fish and fishermen, especially in nearshore waters where they are most accessible to offshore fishermen. In the central and western Gulf new platforms will replace some of the expected removals in the areas where several thousand existing petroleum structures are currently a common focus of offshore marine recreational fishing. However, by the year 2036, approximately 3,100 platforms are expected to have been removed from federal waters offshore Louisiana and Texas, leaving less than

1,000 active production platforms throughout the Gulf. It is expected that many of the retired gas and oil platforms will be acquired by the Gulf states for construction of artificial reefs.

Oil spills resulting from the OCS program and import tankering have been described earlier under (Section IV.D.1.c(1) and IV.D.1.c(3), Gulf of Mexico Impacts on Water Quality and Marine Mammals. That description includes assumptions of oil spill occurrence, spill sizes, and likely contacts with shoreline and wetlands areas.

Large pollution events such as the 73 oil spills (average size of 30,000 bbl), and 169 petroleum product spills (average size of 11,000 bbl) estimated to occur in the Gulf over the next 45 years will eliminate recreational fishing activities in areas directly affected by oil slicks. Spills of 1,000 bbl or greater once controlled at their source can remain visible in the marine environment for up to two weeks and move several hundred miles in open waters from the point of origin. It is expected therefore that large offshore areas in the Gulf of Mexico, mainly in the northcentral and northwestern Gulf will be avoided by recreational fishermen for a week to 10 days once or twice a year as a result of offshore platform and pipeline spills. Fishing activity is likely to continue however from most Gulf recreational fishing ports, marinas and access sites unless the spill comes ashore and fouls beaches, piers, jetties, marinas and launch sites. The two spills assumed to impact the western Louisiana and eastern Texas coastline will discourage marine fishing activity and contribute to a decline in the sale of recreational fishing supplies and services at marinas, piers and beaches directly effected by the pollution for several weeks or until the spill is cleaned up. Should Ship Island be impacted, for example, the National Park Service would close the island to public use until the cleanup is completed. Of the 63 import spills, and the 169 petroleum product spills estimated over the next 45 years, 31 are assumed to occur in nearshore waters and are likely to remove shoreline fishing areas and nearshore waters impacted in the northwestern (Texas) and northcentral (primarily Louisiana) Gulf of Mexico from fishing activities for one to three weeks or until clean up activities are complete. Recreational fishing activities should resume at prespill levels soon after obvious evidence of the spill is removed. Some loss in sales of recreational supplies, services and equipment will occur in coastal fishing communities directly fouled by these large spills. Major spills within or near major merchant shipping or industrial ports (Houston, New Orleans, Mobile) are unlikely to effect recreational fishing or the fishing industry.

In summary, the continued growth and expansion of oil and gas leasing will perpetuate and expand the focus of productive offshore recreational fishing in direct association with new production platforms expected throughout the Gulf of Mexico over the next 45 years. Continued gas and oil leasing will contribute to continued economic and population stability and expansion within the Gulf coastal region, and stimulate and support continued growth of the recreational fishing industry. Large oil and petroleum product spills from platforms, pipelines, tankers and barges will remove portions of the offshore, nearshore, and inshore marine waters directly affected by pollution from fishing activities for a week to 10 days from each pollution event. Oil spills coming ashore on coastal beaches, piers, jetties, marinas and boat access sites will lead to a loss in the sale of fishing equipment, supplies and services at the local fishing community level, but should recover shortly after cleanup.

CONCLUSION: Oil and gas leasing in the Gulf of Mexico under the proposed program will expand the focus of offshore recreational fishing and contribute to major oil spill events temporarily discouraging fishing activity in the portions of the Gulf and coastal areas directly affected by the pollution. The incremental contribution of the proposed action is expected to add additional production platforms to the 3,760 that already exist. When annual removals are considered, the net effect of additional installations will result in extending the time and range of the offshore fishing phenomena in the Gulf of Mexico. Likewise, the proposal is likely to contribute oil spills to the numerous other pollution events expected to occur in the Gulf throughout the life of the proposal. Pollution events along with extreme weather conditions and growing competition for marine fishery resources should slow the growth rate of the marine recreational fishing industry in the Gulf of Mexico region over the next 45 years.

(b) Alaska Region

COMMERCIAL FISHING: All of the cumulative offshore oil and gas activities in State and Federal waters described in Section IV.D.1.c potentially could impact commercial fishing. Onshore activities described in Section IV.D.1.c would not affect commercial fishing.

The routine elements of the scenario that may affect commercial fishing are as follows: OCS-vessel traffic that could conflict with commercial-fishing traffic, especially in areas such as enclosed bays; wells, platforms, and offshore pipelines; and onshore marine bases that are also used by the commercial- fishing industry. The number of wells, platforms, and pipelines for each sale area is listed in the scenario. Details of the way in which these OCS elements may affect commercial fishing are described in the proposed action for commercial fishing.

Oil spills, as described in the scenario, could affect commercial fisheries. Oil spills could come from platforms, offshore pipelines, or tankers carrying oil. It is anticipated that cumulative activities will not add appreciable impacts to those of the proposed action.

Potential adverse effects on the commercial-fishing industry include: (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; (3) loss or damage to fishing vessels through collisions with oil-industry vessels; (4) competition for support services, infrastructure, materials, and labor; and (5) competition for space onshore. Details of how these adverse effects my occur are presented in the proposed action for commercial fishing.

Oil spills could damage the commercial fisheries by gear fouling; preemption or closure of fishing areas; direct loss of catch; and contamination or tainting of harvest. The probabilities of an oil spill occurring for the cumulative case in each of the sale areas are described in the scenario. The estimated spill sizes given in the scenario are: 20,000 bbl for platform, 25,000 bbl for pipeline, and 30,000 bbl for tanker. Small spills of less than 1,000 bbl are described in the scenario. Impacts on water quality from oil spills that are analyzed in the water-quality section are used in analyzing impacts on commercial fish. The conclusion of that section is that water quality on up to several thousand square kilometers is expected to be reduced by hydrocarbon contamination for about 30 days.

Details of how an oil spill may affect commercial fisheries are described in the proposed action for commercial fisheries.

None of the stipulations that potentially would be adopted for the five sale areas with commercial fishing would change any impacts.

For each of the sale areas with commercial fishing, it is expected the impact of the cumulative case on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear in the range of up to 5 percent and loss of secondary employment in the range of up to 5 percent resulting from (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; and/or (3) loss or damage to fishing vessels through collisions with oil-industry vessels. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor as a result of increased competition. Costs to commercial fishermen are expected to increase no more than 10 percent for space onshore as a result of increased competition. These impacts are expected to last for as many seasons as there is OCS activity. In the proposal, only the Chukchi Sea has no commercial-fishing activity. These impacts are the same as for the proposed action.

For each of the sale areas with commercial fishing, it is expected that oil spills could damage the commercial fisheries by gear fouling; preemption or closure of fishing areas; direct loss of catch; and contamination or tainting of harvest. The probabilities of an oil spill occurring in each of the sale areas are described in the scenario. The estimated spill sizes given in the scenario are: 20,000 bbl for platform, 25,000 bbl for pipeline, and 30,000 bbl for tanker. Small spills of less than 1,000 bbl are described in the scenario. Commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days, the commercial fisheries are expected to have a up to 5 percent loss of catch, and up to 5 percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil could be up to 5 percent. In the proposal, only the Chukchi Sea has no commercial-fishing activity. These impacts are the same as for the proposed action.

CONCLUSION: For each of the sale areas with commercial fishing, it is expected the impact of the cumulative case on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear in the range of up to 5 percent and loss of secondary employment in the range of up to 5 percent. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor and no more than 10 percent for space onshore. These impacts are expected to last for as many seasons (30-year period of proposal) as there is OCS activity.

As a result of an oil spill, commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days, the commercial fisheries would have a up to 5 percent loss of catch and up to 5 percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil is expected to be up to 5 percent. There are 17 spills assumed for the Alaska Region. All of the impacts from routine activity and as a result of an oil spill are the same for the cumulative case as for the proposed action. All increases described in this conclusion are due to the proposal.

(c) Pacific Region

1) Commercial Fishing

Factors that may produce cumulative effects on commercial fisheries in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to commercial fisheries in U.S. waters include factors associated with fisheries, industrial and domestic sewage, Los Angeles/Long Beach Harbors (2020) expansion project, southern Sea Otter Translocation Project (USFWS), and Alaskan and foreign-import tankering.

Without the proposal, commercial fishermen are still expected to be affected by, and possibly sustain substantial economic losses from (1) natural fluctuations in fish and invertebrate resources, (2) increased pressures on total available resources and facilities by commercial and sport fishermen, (3) competition among domestic fishermen for resources and space, (4) changes in market conditions and competition with foreign imports for markets, (5) management restrictions on fishery harvests, and (6) increased operating costs and unforeseeable events (e.g., weather).

Changes in the availability of resources, competition for limited resources, access to fishing grounds, onshore facilities and markets, regulations, and operating costs are probably the most important factors contributing to economic stresses on commercial fisheries. Of factors affecting the availability (and potentially total catch of commercial fishermen), natural fluctuations in abundance of commercially valuable fish and invertebrate resources is probably the most important. Unpredictable, but naturally induced events such as the El Niño event of 1982-1983 have been shown to have far-reaching and measurable economic impacts to most commercial fisheries and associated industries. While other natural events may be more limited in scope (e.g., the unknown cause of decline in abalone populations at Santa Rosa, Santa Cruz and Anacapa Islands), they none the less result in reductions of specific fisheries (e.g., dive fisheries). Any additional activity or project which may adversely affect fishery resources (e.g., fishing pressures, chronic effects of effluents and discharges, habitat degradation) compounds and/or sustains these economic difficulties (see cumulative impact analysis for fishery resources Section IV.D.1.a(6)).

Competition among domestic commercial fishermen and sport anglers for limited resources and access to fishing grounds already exists and is expected to intensify as resources are further diminished. Fishing pressures are expected to remain high as demand for species favored by both sport and commercial fishermen increases, sportfishing populations grow, and commercial fishing practices become increasingly efficient. Occasionally, access to traditional fishing grounds (e.g., set gill net fisheries) are limited by projects designed to enhance sportfishing opportunities (e.g., placement of artificial reefs).

Competition also occurs among members of the same fishery for limited resources, as well as among commercial fisheries for fishing space. Limited entry restrictions on currently unlimited fisheries will act to reduce competition levels somewhat, but at the same time may limit opportunities for fishermen to switch gears. Less traditional fisheries such as mariculture operations may limit access to prime nearshore fishing grounds (e.g., in the Santa Barbara Channel). As cost/benefit ratios increase and solutions to nearshore coastal pollution are found, the amount of area occupied by mariculture operations may be expected to increase, although this is not expected to have substantial regional effects.

The potential for conflict between a natural predator (i.e., the southern sea otter) and human predator (principally dive fishermen and potentially pot/trap fisheries) for the same prey (e.g., sea urchins, abalone, spiny lobster) now exists at San Nicolas Island. It is too early to predict the success of the southern Sea Otter Translocation Project conducted by the USFWS and hence the impacts to commercial shellfisheries. However, if successful, translocation could have significant adverse impacts within five years on commercial shellfisheries that contribute substantially to landings in the Santa Barbara Subregion (USDOI, FWS, 1987b). Impacts to shellfisheries are predicted to range from low (less than 10 percent economic loss) to moderate (10-20 percent economic loss) with recovery requiring two seasons or less (USDOI, FWS, 1987b). Potentially prohibition of gill and trammel netting in nearshore areas to protect otters from incidental take could result in low economic losses to these fisheries as well (USDOI, FWS, 1987b). Loss of San Nicolas Island as a fishing ground is likely to increase pressure and crowding at other sites as fishermen shift target areas. Harvestable kelp may increase following introduction of otters, representing a potential benefit for the commercial kelp harvesting industry (USDOI, FWS, 1987b). The most important need of fishermen is for a market to exist to sell their products. The price for most species fluctuates with product availability and demand. In many cases, fishermen receive less than they would otherwise, when demand is low and/or supply is high. Market conditions are quite volatile, changing frequently within a single fishing season. Markets will continue to be difficult to maintain steadily considering the competition created by lower priced foreign imports, fluctuation in the U.S. dollar, and lack of continuity from one season to the next due to natural fluctuations in the availability of fishes.

Improved stability of the commercial fishing industry in the 87 tract area will by necessity rely more and more heavily on market (fresh) fish commodities and non-tuna cannery species such as mackerel, squid, and anchovy. Consequently, higher fishing pressures will be placed on these resources.

Fishing restrictions are designed primarily to protect fishery resources for recovery and/or future purposes, but in some cases may afford protection to other species (e.g., marine mammals) from net entanglement. Improved projections and more realistic stock assessments may lead to relaxation of regulations in some cases, but others may become more stringent. Limits on the amount or mix of catch acceptable to fishery managers and buyers can promote waste and discard of incidental catch. Limited entry restrictions designed to protect waning resources may reduce competition among domestic fishermen and alleviate pressure on some resources, but can also limit opportunities to switch gears with seasons. Recognition of limited opportunity is likely to promote the issuance of more experimental permits targeting species which are currently underutilized causing some expansion into new areas and products.

Operating costs are already high and costs associated with insurance, fuel and docking fees are expected to continue to rise. Short-term economic losses frequently result from unforeseeable events. Consequences to individual fishermen working on a narrow profit margin can be catastrophic if economic gains are reduced (e.g., fishing is limited by poor weather) or unexpected costs are incurred (e.g., loss of vessels or gear from natural events or from man's activities).

Multiple use conflicts are likely to occur between commercial fishermen and the military, as well as between commercial fishermen and oil and gas industries. Most military maneuvers normally occur offshore and within recognized zones, thus spatial preemption of fishermen during military activities is fairly localized and short-term lasting a few days to weeks. In contrast, oil and gas structures are a continuing presence on the OCS, preempting primarily commercial trawl fishermen, as well as fishing areas used by drift gill net and purse seine fisheries.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluent have been reviewed in Section IV.D.1.c. Impacts are greatest near large metropolitan areas, particularly the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern california (SCCWRP, 1986). Although greater strides will be made to decrease or at least limit the amount of sewage entering the southern California region, with a projected 50 percent increase in the coastal population by the year 2010, pollution and its effect on fish of southern California will remain its present level over the next 35 years. The reduction of fishery stock due to pollution and possible overfishing could lead to reduction of commercial fisheries over the next 35 years, particularly in the southern California area.

Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms are expected to occur at some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal and State waters, 10 projected platforms, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time.

The 17 added platforms can act as physical obstructions to a variety of commercial fishing activities, particularly trawl fisheries. Purse seine and drift gill net fisheries can also be affected, but generally to a lesser extent. Since trawlers generally target less mobile benthic species and follow specific bottom depth contours during operations, few fishing alternatives (e.g., a change in location relative to depth) exist if their preferred pathway is blocked.

Since virtually all of the trawling grounds of the Southern California Planning Area are found in the Santa Maria Basin and Santa Barbara Channel regions, any structures located in these areas could impact trawl fishing operations. Fishermen may be forced to alter their fishing patterns and expend more effort to maintain their current level of harvest to compensate for the area lost due to platform installation. The affected area remains small enough, compared to the area under consideration, that fishing in what is essentially the same fisheries ground would not be prevented. Consequently, there will be little or no discernible economic loss or change in the availability of commercial fish stocks. The inconveniences will last for the life of the platform or 35 years.

Only a limited amount of area remains unobstructed in the Santa Barbara Channel for gill net fishermen and more than a couple of platforms developed in this area could result in economic loss of around 10 to 20 percent during the life of the platform to individual fishermen targeting the Channel.

Purse seine fisheries are expected to experience, at most, minor inconveniences due to the presence of offshore structures. These fisheries target pelagic species which occur throughout the entire Southern California Bight, and preclusion from 17 platform sites will not affect the availability of harvestable species or result in regional economic losses.

Seventeen pipeline corridors totaling 120 miles are projected in the cumulative case. It is also assumed that one pipeline from an existing lease will be constructed to a shoreline landfall in the northern Santa Maria Basin. Impacts to regional commercial fishing operations during pipeline installations are expected to be of minor inconvenience and short term, with each installation lasting three to six months.

Localized problems could result from the installation of pipelines which may continue for longer periods of time. For example, anchor scars and mud mounds created by a pipeline construction barge prohibited trawl fishermen from working a portion of the eastern Santa Barbara Channel at the anchor scar mounds.

Based on the relatively few structures involved, their assumed dispersion over a large area, and the widely dispersed nature of many fisheries, the impact of manmade structures on commercial fishing is expected to involve inconveniences over the life of the platform with less than a 10 percent economic loss in any season. Although the platforms prohibit fishing, essentially the same fishing grounds can still be utilized.

Other operational effects would involve vessel traffic (construction barges and tugs, service and supply boats, tankers, and seismic survey vessels) of varying duration and frequency. Vessel traffic associated with OCS oil and gas operations offshore California would generally involve minor short-term inconveniences without measurable economic losses due to the relatively small area utilized by OCS-related vessel traffic. In addition, the fisheries most susceptible to vessel traffic, fixed gear (e.g., set gill nets, set longlines, pots/traps), occur in relatively shallow water depths and are inshore of established vessel traffic corridors.

Noise and disturbance associated with OCS exploratory and development activities in the Pacific Region could combine with disturbance from other sources to increase cumulative impacts. Generally, however, space use conflicts with mobile gear fisheries are ephemeral and overall impacts are expected to involve minor inconveniences lasting for days to a few weeks, except where fishing grounds or seasons are very restricted.

It is assumed for the cumulative scenario that about 48 exploration and delineation wells and 570 development wells each with approximately 2,000 bbl of drill cuttings and an estimated total of 3,000 to 3,300 bbl of drilling fluids and muds will be intermittently discharged over the life of each well. Routine discharges from wells and platforms could cause sublethal or lethal impacts to a few individual fishes concentrated at the outfall discharge point of each drill site. Measurable impacts to commercial fishermen are unlikely and expected to be a minor inconvenience well below economic detectability lasting for a season.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on fisheries. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

Impacts on commercial fisheries from oil spills have been discussed in Section IV.D.1.a(11)). Locally, more than half of the combined landed value to ports within the Santa Barbara region is composed of sea urchin, abalone, lobster and crab harvested by fixed gear fishermen and commercial divers. If catches were reduced as a result of an oil spill, the subregion could experience a number of impacts, including high economic losses for two seasons ranging from 20 to 30 percent, and more than 10 percent unemployment among fixed-gear fishermen. Similar impacts would occur in Washington, Oregon, or other areas of California.

Assuming the oil spill contacted important fishing areas and tainted fisheries resources or contaminated fishing gear, fishermen could be expected to sustain economic losses for about one month or as long as it takes to clean their gear. Assuming a large oil spill contact to a fishing port and fishermen were prevented from leaving port by oil containment booms, fishermen could sustain complete economic losses during the period that the booms are in place (about one month). The consequences of an oil spill to the regional fishing industry would be most severe if oil contacted Los Angeles and Long Beach Harbors and port closure resulted. Since this harbor receives the bulk of commercial fish landings for southern California, a reduction in activity could have repercussions on local, regional and statewide levels. Overall, however, oil spill impacts on commercial fisheries will not be discernible from normal fluctuations of commercial fisheries within the Pacific Region.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). Although a few individual fish could be killed by a small spill, regional fish populations are not expected to be affected at a level detectable above natural population level fluctuations. Further, fishing vessels can maneuver around most small spills, reducing the probability of fouling fishing gear. Also, small spills are not likely to result in port closures which can limit the opportunity for fishermen to harvest.

In summary, pressures on commercial fisheries will continue to come from natural year to year population and distribution fluctuations and periodic catastrophic events, such as El Niño of 1982-1983. Competition among domestic and foreign as well as from sports fisheries could result in over-fishing and decrease in the fishing stock resulting in increased unit per effort and/or limited entry restrictions on certain fisheries. Operation costs, already high will continue to increase. Multiple use conflict with the military, oil and gas industry, could further reduce certain fisheries, including trawl, drift gill net and purse seine fisheries, could further contribute to fisheries reduction. Increased domestic and industrial sewage associated with population increase could also reduce commercial fisheries.

Impacts to commercial fisheries due to routine activities are expected to involve inconveniences lasting for the 35-year life of the platform with little or no discernible economic loss. Impacts from oil spills would result in economic losses ranging from 20 to 30 percent lasting for two seasons and more than 10 percent unemployment of the fixed-gear fisherman and financial losses of 10 to 20 percent of economically dependent businesses in the local fishing area and port facility within range of the spill. HOwever, impacts from oil spills will not be discernible from normal fluctuations of commercial fisheries within the Pacific Region overall.

CONCLUSION: Commercial fisheries will continue to decline over the next 35 years. The primary cause of the decline will continue to be competition for resources, space within the industry, recreational fishing pressure, coastal development, and domestic and industrial pollution near large metropolitan areas. Impacts to commercial fisheries due to routine OCS activities are expected to involve inconveniences lasting for the life of the project with less than 10 percent economic loss in any year. Impacts from the assumed spills will not be discernible from normal fluctuations of commercial fisheries within the Pacific Region overall.

2) Recreational Fishing

Factors that may produce cumulative effects on recreational fisheries in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts to recreational fisheries in U.S. waters include factors associated with fisheries, industrial and domestic sewage, Los Angeles/Long Beach Harbors (2020) expansion project, southern Sea Otter Translocation Project (FWS), and Alaskan and foreign-import tankering.

Any activity or project which may potentially impact fish resources could contribute to adverse effects on sportfishing by decreasing the total catch available. Major factors potentially contributing to reductions in fish resources are discussed in detail in Section IV.D.1.c(6), (Cumulative Impacts on Fish Resources). Of these factors, increased fishing pressure from commercial and recreational fishermen is expected to contribute most to man-induced stresses on fish resources. Fishing pressures are expected to remain high as demand for favored species by both sport and commercial fishermen increases, fishing practices become increasingly efficient, and participation in sportfishing accelerates as a function of coastal population growth. This will result in declines in some fish stocks and ever increasing competition among sport and commercial fishermen for remaining stocks. Competition for invertebrate resources (abalone and possibly, spiny lobster) between sportfishermen (divers) and natural predators (sea otters) may also develop. Translocation of sea otters to San Nicolas Island by the USFWS may result in local declines of abalone at this location. However, considering the low level of sport diving activity at this island relative to all other islands, impacts to sport divers from the translocation project are expected result in minor inconveniences lasting one season or less. Economic losses are not discernible from losses due to natural variations in marine recreational fish harvest.

Alternatively, sportfishing may be enhanced by improved management of fish stocks, initiation of programs directed toward stock enhancement, promotion of capture-and-release type fishing, researching ways to promote fishing of under-utilized species, the potential placement of additional oil and gas platforms (up to 17) in the southern California area, as well as accelerated efforts to install artificial reefs. Most of these activities, designed to improve sportfishermen's success, and though more appropriate south of the proposed sale area, may help to alleviate and partially offset adverse effects and potential conflicts among users.

Oil is but one of many possible contaminants that may taint fishes and lead to concerns for human health. Tainting of resources and/or subsequent fear of contamination may result from a variety of activities. Increased levels of contaminants are associated with chronic exposure to discharges from publicly/privately owned vessels, municipal sewage treatment plants, urban runoff, harbor flushing, and natural oil seeps. The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in section IV.A. Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986). Although greater strides will be made to decrease or at least limit the amount of sewage entering the southern California region, with a projected 50 percent increase in the coastal population by the year 2010 (Section IV.A), it is difficult to be more optimistic than to assume that pollution and its effect fish for recreational fishing in southern California will do other than maintain its present level over the next 35 years.

Increased vessel traffic associated with growth of urban centers, redevelopment and expansion of the Los Angeles Harbor, and tankering of Alaskan and foreign crude oil offshore California and shipments into Los Angeles and San Francisco will effect sportfishermen because of harbor congestion, increased competition for docking space, increased risk to navigation, crowding at and near various marinas, and the lessening of the solitude which may be an important reason (aside from the capture of fish) to sportfish. Eventually berthing, port, wharf and marina space is expected to expand along with planned industrial developments. The proposed action is assumed to back out an equal amount of imported oil. Therefore, the proposed action will slightly reduce the number of import tanker trips into the Ports of Los Angeles and Long Beach. Increased supply vessel traffic associated with the proposed action is unlikely to be at a level sufficient to discourage sportfishing in southern California.

Platform installation and operation are also sources of potential impacts. In the Southern California Planning Area, 48 platforms are expected to occur at some time during the 35-year life of the proposed action. This number includes 31 existing platforms in Federal (23) and State waters (8), 10 projected platforms, and the 7 platforms assumed for the base-case scenario. Since 21 platforms are projected to be removed during this period, it is unlikely that all 48 platforms would be in place at one time.

The 17 added platforms and 120 additional miles of pipeline corridors could lead to reductions in fish populations if critical habitats are lost. In general, however, adverse impacts to sportfishing (all modes) throughout the area under consideration due to the presence of offshore structures are expected to involve minor economically indiscernible inconveniences lasting for the life of the platform. As suggested above, oil platforms are thought of as an enhancement to recreational fishing in terms of concentrating fish, and possibly increasing the total population of certain favored species by adding habitats to the area.

Effluents and discharges from the added wells are likely to cause additional sublethal or lethal impacts to a few individuals near (within several hundred meters) each drilling site. However, no overall discernible decrease in recreational fisheries is expected except immediately around the platform during intermittent discharges of drilling fluids during drilling.

Three possible sources of accidental oil spills must be considered in an analysis of the cumulative effects of oil spills on benthic communities. Two of these, the tankering of Alaskan-produced oil through the TAPS system and the tankering of imported foreign oil, are non-OCS activities and will occur with or without implementation of the proposed Comprehensive Program. The third source includes the transport of oil produced by existing, projected, and proposed OCS activities in the Alaska and Pacific Regions.

Larger oil spills (7,000 to 30,000 bbl) considered under the cumulative case have been described earlier under Pacific Water Quality (Section IV.D.1.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size.

Impacts on fish resources from oil spills have been discussed in Section IV.D.1.a(11). Oil spills tend to preclude all sportfishing in the affected area until cleanup or dispersion of oil occurs. A spill (1,000 bbl or more) may result in the loss of fish and invertebrate resources, decreased resource accessibility, and possibly reduced desirability of fish and invertebrates through tainting in all areas of the Pacific Region. However, the mobility of the party and private vessel sportfishing fleet will facilitate avoidance of affected areas and lessen the impacts from possible reductions in available catch, possible capture of tainted fish, and contamination of gear.

Oil spill contacts to the shoreline or offshore islands in southern California would have important impacts on shore fishermen and sport divers. Fishing and diving activity would be halted until after cleanup operations are completed or the spill had been dispersed by wind and wave action.

Assuming the oil spill contacted a harbor anywhere in the Pacific Region where sport boat operations concentrate, operators of commercial passenger fishing vessels and skiff rental facilities may sustain local temporary (about one month) economic losses (10-20%). These losses could be attributable to any or all of the following factors: adverse publicity keeping fishermen away from the affected area; vessel confinement to port by oil containment booms; or inability to shift fishing operations outside the immediate vicinity of the spill. Economic impacts would be greatest in southern California in areas of highest party/charter boat activity including Santa Barbara Harbor, Ventura Harbor, Channel Islands Harbor (Oxnard), Port Hueneme, and possibly as far south as Los Angeles Harbor. Regionally, economic costs to the sportfishing industry of oil spills are expected to be minimal having no discernible economic impact due to the large area involved and the number of harbors that are likely to be unaffected by a spill.

In the cumulative-case scenario for the Pacific Region, it is assumed that 116 oil spills of 1-50 bbl and 4 spills of 51-999 bbl will occur over the life of the proposed action (see Table IV.D.1.c-6). Because these very small spills are expected to have very little impact on local or regional invertebrate and fish populations (Section IV.D.1.a(6)) little if any impact to sportfishermen is expected.

The synergistic effects of chronic pollutants from expanding marine-related industries and urban development, and increasing competition among a growing sportfishing population and existing commercial fishing industries for the most desirable target species is likely to have an adverse effect on catch rates. As a result, the quality of the fishing experience is expected to deteriorate with time. Adverse effects may be partially offset by improved management of marine fishery resources, stock enhancement programs, installation of artificial reefs, and improved control and abatement of chronic pollution as public awareness of the problem grows. Although difficult to predict, natural environmental factors are also likely to contribute to long-term changes in resources available to sportfishermen and vagaries of outside economic forces (e.g., recession, fuel shortages) will influence future participation.

In summary, future declines in recreational fisheries are directly or indirectly related population increases in the metropolitan areas of southern California. Fishing practices become increasingly efficient, and participation in sportfishing accelerates as a function of coastal population growth. This will result in declines in some fish stocks and ever increasing competition among sport and commercial fishermen for remaining stocks. Increased vessel traffic associated with growth of urban center, redevelopment and expansion of the los Angeles Harbor, and tankering of Alaskan and foreign crude oil offshore California and shipments into Los Angeles and San Francisco will effect sportfishermen because of harbor congestion and increased competition for docking space. Further stresses on recreational fisheries will come from domestic and industrial pollution, also a function of population and urban growth.

Routine activities associated with the proposal are expected to result in economically indiscernible minor inconveniences to marine recreational fishing activities within the are of the proposed action. The length of these impacts is highly variable ranging from a season or less for drilling discharges and for the 35-year life of the project form structures and vessel traffic. Oil spills will contact harbors used by sport fishermen with impacts expected resulting in local economic losses of 10 to 20 percent over a period of approximately a month, or the length of time needed for spilled oil to be cleaned up or dissipated by wing and waves. No discernible region wide impacts anticipated since not all harbors will be contacted, particularly at one time.

CONCLUSION: Recreational Fisheries will continue to decline over the next 35 years. The primary cause of the decline will continue to be competition for resources and dock space due to increased commercial and recreational pressure, urban development, domestic and industrial pollution near large metropolitan areas, and increased vessel traffic due to population growth and urban development. Routine OCS activities associated with the proposal are expected to result in economically indiscernible minor inconveniences to marine recreational fishing activities within the area throughout the life of the project from structures and vessel traffic. Impacts from routine operations and the assumed spills will not be discernible from routine fluctuations of commercial fisheries within the Pacific Region overall.

(d) Atlantic Region

1) Commercial Fishing

Impacts from these activities are similar to those described in Section IV.D.1.a. Non-OCS activities which are expected to impact commercial fisheries in the Atlantic Region during the next 30 years include loss of critical habitat (spawning and nursery grounds) from coastal development or environmental degradation, tankering of imported oil through the area, and the commercial fishing industry itself.

The number, size, and location of oil spills have been discussed previously.

The current burden of pollutants from sources other than offshore oil and gas activities poses a threat to commercial fisheries. Particularly vulnerable are spawning and nursery grounds in coastal areas, many of which are located in areas subject to anthropogenic pollutants. In many coastal areas, degraded water quality (usually high fecal bacterial colony counts from human wastes) has closed shellfishing beds to harvest. A little over 8 million acres, or 81.6 percent of the total acreage classified for production in the Atlantic Region, were approved for shellfish harvest in 1980. By 1990, this figure had dropped to 6.9 million acres or 73.0 percent of total classified acreage (Eric Slaughter, pers. comm., 1990)

Loss of wetlands through dredge and fill activities and coastal development also poses a threat to commercial fisheries. Some states, such as Maryland, have recently (1991) implemented strict, "no-net-loss" regulations for wetlands. These regulations are designed to prevent wetland loss either directly by prohibiting development, drainage, or alteration of these areas, or by requiring the creation of an equal area of wetlands for those areas destroyed. By contrast, other states, such as New

York and New Jersey, have regulations governing wetlands loss that, on measure, allow for continued loss of wetlands in their state with no mitigation.

Presently, transportation of petroleum products by tanker through the near- and offshore waters of the Atlantic Region poses the risk of a large oil spill in the vicinity of fish spawning areas. Under this scenario, commercial fisheries in the mid-Atlantic are most vulnerable to a large spill of imported oil from a tanker. Although serious impacts to nearshore fisheries have been documented after tanker accidents in coastal waters, few, if any, oil spill related impacts on commercial fish populations in the open ocean have been documented. This may be due to the relatively rapid dilution and weathering of oil in open ocean, high-energy environments. This may also result from an inability to detect oil spill induced changes in fish populations due to the high natural variability in fisheries recruitment. Nevertheless, a large oil spill, particularly in nearshore waters, is expected to result in mortalities of adults and juveniles, loss of recruitment to the population, and subsequent reductions in future catches. The effects of oil spills on fisheries are discussed in detail in Section IV.D.1.a.

By far the greatest impact on commercial (and recreational) fisheries comes from the fishing industry itself. With up to 70 percent of some harvestable stocks removed by fishing each year, most of the stocks of the historically desirable finfish are fully exploited (USDOC, NMFS, 1988), and many have declined in abundance. Increased fishing effort, with the resultant elevated fishing mortality, is probably the major cause of the drop in total commercial landings in the Atlantic Region from a peak in the early 1980's. The decline in landings has been accompanied by shifts in species composition, with previously less-desirable species now accounting for a greater proportion of the catches.

Economics, fishing methods, and fishing practices also play a role in current trends in commercial fisheries. High costs of fishing force many fishermen to maximize their cash flow by fishing only for the most valuable species. This often leads to higher rates of discard of bycatch and less valuable species. These discards represent fish that were potentially available to the commercial fishery. Problems associated with fishing methods and practices are expected to continue or worsen as competition and fishing costs increase over the next 30 years.

Economic pressures (and regulations) also have led to changes in fishing methods over the last 10 to 20 years with the introduction of more efficient techniques. Some of these techniques, such as hydraulic escalator harvesters used for clam production, have significantly increased landings by allowing fishing of essentially virgin stocks (Street, 1989). Other practices, such as the controversial clam harvesting method in North Carolina known as "kicking" (which essentially removes the sediments from around hard clams which are then caught by an otter trawl), may have long-term indirect adverse impacts on stocks by altering the animals' habitat (CSA, 1983).

It is likely that heavy pressure will continue to be exerted on fisheries in the Atlantic Region as demand for fish products has increased over the past two decades. Many of the commercial fisheries stocks are intensively fished and now depend on only one or two year classes to sustain the fishery. Increased coastal development with its concomitant loss of wetlands and increased runoff will also continue to stress fisheries.

CONCLUSION: Under the cumulative scenario for the proposed action, impacts on commercial fisheries are expected to produce measurable economic losses lasting more than one to two seasons with measurable economic losses in secondary employment. The major source of the impact will be the commercial fishing industry.

2) Recreational Fishing

Routine OCS activities which are expected to impact recreational fisheries are similar to those assumed in Section IV.D.1.b. Impacts from these activities are described in Section IV.D.1.a. Non-OCS activities and accidents which are expected to impact recreational fisheries in the Atlantic Region during the next 40 years include loss of critical habitat, pollution, fishing pressure, and tankering of imported oil. As described in Section IV.D.1.a, biological resources could be identified by the MMS Regional Director as requiring special protection.

Most recreational fisheries occur inshore (Section III.D.3.b and IV.D.1.a) where the consequences of human activities are the most pronounced. In many coastal areas, runoff from municipal, industrial, and agricultural sources has resulted in contamination of estuarine and nearshore waters. With increasing population pressures along the Atlantic coast, combined with heavy burdens of contaminates presently bound up in the sediments, contamination of estuarine and coastal areas is expected to continue over the next 30 years.

Loss of nursery and spawning grounds from loss of wetlands and submerged aquatic vegetation remains an important issue. Although some states have moved to prevent further loss of wetlands and other critical habitats, most states are succeeding only in slowing the rate of loss (Section IV.D.1.c.). It is likely that this trend also will continue over the next 30 years. Loss of habitat will result in diminished recruitment to the fishery and, consequently, diminished catches of recreational species.

Over the past several years, the number of recreational fishermen has increased along the Atlantic coast (USDOC, NOAA, 1980 - 1989, inclusive). For some species, recreational fishing exceeds commercial fishing and represents the primary source of mortality (Section IV.D.1.a). As with commercial species, many stocks of recreational species are fully exploited. Assuming this trend will continue with the projected increase in population along the Atlantic coast, pressure on recreational species can be expected to increase.

Under this scenario, the majority (12) of oil spills greater than or equal to 1,000 bbl are assumed to occur in the mid-Atlantic. The effects of these oil spills on recreational fisheries would depend on several factors including the location of the spill and the persistence and bioavailability of the hydrocarbons (Capuzzo, 1985). Because recreational fishing occurs mostly inshore, oil from a spill (1,000 bbl or more) contacting these areas can be expected to cause mortalities of recreational species and adversely affect the recreational fishery. Impacts from a spill could last as long as 12 years in the soft sediments of shallow, protected embayments (Teal and Howarth, 1984).

Continued loss of habitat, particularly nursery and spawning grounds, is expected to continue. In combination with heavy fishing pressure, recreational fisheries can be expected to decline over the next 30 years.

In the absence of special protections, impacts to recreational fisheries would occur primarily in areas with important concentrations of recreational species such as the live bottom habitats of the South Atlantic.

CONCLUSION: Under the cumulative case, impacts on recreational fisheries are expected to produce measurable economic losses lasting more than one to two seasons with measurable economic losses in secondary employment. The major source of impact is expected to be recreational fishing pressure.

(12) Impacts on Subsistence

(a) Alaska Region

The IPA's that could affect subsistence in the cumulative case include existing oil and gas infrastructure on the North Slope and in Cook Inlet; State of Alaska and private (largely Alaskan Native regional corporation) oil and gas lease sales; Canadian offshore and onshore oil and gas lease sales; the transportation of oil and gas by means of tankers and pipelines; offshore and onshore nonenergy minerals leasing activities, such as the Red Dog Mine and gold dredging; coastal development and habitat loss or contamination; commercial fishing; and existing and proposed Federal offshore and onshore lease sales. The probability of any or all of the ongoing and planned offshore and onshore oil and gas projects reaching the development and production stage is unknown; however, the following discussion assumes that all of these projects would reach the development and production stage. The effects of these projects on subsistence may occur because of oil spills, noise and traffic disturbance, or disturbance from construction activities associated with pipelines and shore-base facilities.

Noise and traffic disturbance might come about from seismic activities; constructing, installing, and operating drilling facilities; or supply and tankering operations.

Existing oil and gas production and transportation infrastructure in and around Prudhoe Bay on the North Slope, at Valdez in Prince William Sound, and within Cook Inlet have contributed in different measures to past effects on subsistence and should continue in the future. The subsistence of the North Slope Inupiat has changed considerably since the discovery of oil at Prudhoe Bay and the introduction of the CIP by the North Slope Borough (using the North Slope oil and gas infrastructure as the tax base for bonded indebtedness) to produce increased amounts of disposable income from wage labor which, in turn, has subsidized more efficient and expanded subsistence pursuits. The terminal facilities at Valdez are an integral part of the North Slope oil-transportation system, and the recent *Exxon Valdez* oil spill demonstrated that effects on subsistence would be experienced not only within Prince William Sound (such as at Tatitlek and elsewhere) but also wherever else the oil drifted. Except for specific Alaskan Native groups, the outlook on subsistence in Cook Inlet largely has been reduced to an urban perspective (enjoying the outdoors and filling the freezer) over the last several decades as a result of the urbanization and industrialization of the Kenai Peninsula produced by offshore and onshore oil and gas production on State lands.

Other industrial factors that would impact subsistence in the cumulative case include offshore and onshore nonenergy mineral leasing activities, such as the Red Dog Mine near Kotzebue and gold dredging near Nome; coastal development and habitat modification; and commercial fishing. Commercial fishing has the potential for altering food supplies for marine mammals used for subsistence, especially the extremely large foreign and domestic trawler and factory-ship fleets that operate in the Bering Sea. The increasing use of Unalaska as a service and processing base for the fishing industry as well as a marine shore base for offshore activities on the Bering Sea OCS suggests that subsistence in that community would continue to deteriorate in the cumulative case as a result of habitat loss and marine pollution. Coastal development and habitat modification elsewhere in Alaska is occurring at other community sites. The Prudhoe Bay industrial complex and other industrial complexes on the North Slope and in Cook Inlet also have reduced habitat and thereby affected subsistence resources.

Existing and future production and transportation from offshore and onshore oil and gas sales on Federal, Canadian, State of Alaska, and private lands primarily would affect subsistence on the North Slope, where the most dominant focus of such sales activities exists and where the social system is primarily sustained by subsistence activities. Environmental impact statements prepared most recently for Federal OCS lease sales in the Beaufort (Sale 124) and Chukchi (Sale 126) Seas have suggested that a cumulative impact level would result from these sales in most NSB communities that was the result of one or more important subsistence resources becoming unavailable, undesirable for use, or available in greatly reduced numbers for a period of 1 to 2 years. Adding two more sales to the Chukchi and Beaufort Seas, respectively, in a 5-year period (1993-97) for a total of four more sales in this area suggests that such impacts to subsistence would be reached and perhaps exceeded by extending the duration of limited availability or accessibility of important subsistence resources. The specific resources at risk in these cumulative-case analyses varied, but they included anadromous fishes impacted by causeways, walruses and seals impacted by the construction and operation of landfalls and support bases, bowhead whales impacted by noise and potential oil spills, and caribou impacted by construction of a pipeline landfall combined with onshore oil field activities. Loss of endangered bowhead whales by means of oil spills could influence decisions concerning the number of kills (or struck and lost) allowed in the annual subsistence harvest, but it is unlikely that losses from oil spills would begin to reach the annual loss sustained by subsistence hunting of the bowhead whale. Reduction of harvest quotas would reduce the quantity of whale meat, muktuk, and blubber available for distribution as well as reduce the opportunity for whaling captains to acquire increased sociopolitical status in their communities.

Transportation of oil from Federal, State, and private prospects on the North Slope in the cumulative case through the TAPS to market via tankers would introduce additional risk from arctic oil spills to subsistence resources and resource users in Prince William Sound, along the eastern coast of the

Kenai Peninsula, and within Shelikof Strait. If oiling of subsistence resources and resource habitats occurred, subsistence resources would be lost, inaccessible, or perceived to be unusable; and such effects would last for several years. It is unlikely that a spill from a TAPS tanker would reach the beaches of Yakutat because of the distances from shore such vessels travel. If this were not the case and the spill occurred during spawning, anadromous fishes used for subsistence in Yakutat would be affected (probably for just one season), because Gulf of Alaska beaches are used for seine fishing.

Effects on subsistence from lease sales proposed in the Bering Sea would be extended to southern Bering Sea communities located along the Alaska Peninsula and on the Pribilof Islands with the tankering of oil from the northern Bering Sea prospects. The subsistence of the Pribilof Islands would be especially vulnerable because of the dependence by residents living there on the fur seal, which is extremely at risk from oiling.

In summary, existing and future production and transportation from offshore and onshore oil and gas sales on Federal, Canadian, State of Alaska, and private lands would primarily affect subsistence on the North Slope, where the most dominant focus of such sales activities exists and where the social system is primarily sustained by subsistence activities. Recent environmental assessments of Federal OCS lease sales in the Beaufort and Chukchi Seas have suggested that most NSB communities would experience a cumulative impact that was the result of one or more important subsistence resources becoming unavailable, undesirable for use, or available in greatly reduced numbers for a period of 1 to 2 years. Adding two more sales in a 5-year period (1993-97) to each of the Chukchi and Beaufort Seas for a total of four more sales in the Arctic suggests that such impacts to subsistence would be reached and perhaps exceeded by extending the duration of limited availability or accessibility of important subsistence resources.

Transportation of oil from Federal, State, and private prospects on the North Slope in the cumulative case through the TAPS to market via tankers would introduce additional risk from arctic oil spills to subsistence in Prince William Sound, along the eastern coast of the Kenai Peninsula and the Alaska Peninsula, and on Kodiak Island. If oiling of subsistence resources and resource habitats occurred, subsistence resources would be lost, inaccessible, or perceived to be unusable; and such effects would last for several years.

Effects on subsistence from lease sales proposed in the Bering Sea would extend to southern Bering Sea communities located along the Alaska Peninsula and on the Pribilof Islands with the tankering of oil from the northern Bering Sea prospects. The increasing use of Unalaska as a service and processing base for the fishing industry as well as a marine shore base for offshore activities on the Bering Sea OCS suggests that subsistence in that community may continue to deteriorate in the cumulative case as a result of habitat loss and marine pollution.

CONCLUSION: Impacts on subsistence in the cumulative case would be focused primarily on North Slope communities because of arctic oil production and secondarily on communities in southcentral Alaska as a result of oil-spill incidents involving tankers transporting arctic oil from the Port of Valdez. The resulting effects of the proposal on subsistence of North Slope communities would constitute the reduced availability, accessibility, or desirability for use of important subsistence resources for one or more periods of at least 1 to 2 years. Other cumulative factors contribute very little to this level of effect. Subsistence in Bering Sea communities would also be subjected to increased risk as a result of tankering and Bering Sea sales but not to the extent possible from the production and transportation of arctic oil. Federal OCS activity is expect to contribute less than 10 percent of the oil tankered from Alaska and of the cumulative impact of oil spills.

(b) Pacific Region

Factors that may produce cumulative effects on subsistence activities in the Pacific Region include both non-OCS and OCS-related activities. Major sources of non-OCS oil and gas cumulative impacts include increases in human gathering/trampling, municipal and industrial discharges, the Ports of Los Angeles/Long Beach 2020 Master Plan, and Alaskan and foreign-import tankering.

There are 23 platforms in place in the Pacific OCS Region at present, including three platforms awaiting start up and two platform jackets. Ten additional platforms are projected to be installed on existing leases over the life of the proposed 5-Year program. Seven platforms are hypothesized to be installed as a result of this proposal. A total of 21 platforms are expected to be removed from the OCS over the 35 year life of the proposal. No new onshore facilities will be constructed to support hydrocarbon development from blocks included in the proposed leasing schedule. Oil and gas processing will occur at existing or currently planned sites. Consequently, no onshore archaeology sites will be disturbed.

A total of 8 platforms and 6 artificial islands are in place in State waters, and are producing hydrocarbons. No additional offshore oil and gas facilities are anticipated in State waters. Subsistence gathering areas are primarily located in nearshore areas. Since federal platforms will be outside of 3-miles, and no State platforms are anticipated, no impacts are expected.

It is also assumed that one pipeline from an existing lease will be constructed to a shoreline landfall in the northern Santa Maria Basin. Potential impacts associated with offshore pipeline construction include bottom disturbance along the corridor up to the landfall. These impacts will be limited to the immediate vicinity of the pipeline project and are expected to last for the duration of the installation process, approximately three months.

Subsistence gathering activities within the affected area would be curtailed. However, no noticeable impact to subsistence gathering is expected.

Rocky intertidal communities along the Pacific coast are important areas for subsistence gathering activities. For decades (Frey, 1973) it has been known that the greatest damage to rocky intertidal communities on the mainland coast of the Southern California Bight is due to human trampling, collecting, gathering and simple disregard for the delicateness of the area. In addition to subsistence gathering, invertebrates are collected for food, bait and specimens. There are also indirect effects of collecting: mussel clumps are torn apart during searches for worms used as bait, boulders are overturned and left, while clam diggers leave highly disturbed depressions in boulder fields. During the last two decades gathering from intertidal areas has increased, and is expected to continue. Easily accessible areas near large population centers (see Section IV.D.1.a(9)) are the most vulnerable. The availability of species important for subsistence gathering are expected to be noticeably reduced.

The sources and amounts of municipal and industrial wastewater discharges and other onshore effluents have been reviewed in Section IV.D.1.c. Impacts are greatest near large metropolitan areas such as Puget Sound, San Francisco Bay, and, particularly, the Los Angeles-San Diego area. An estimated 1.2 billion gallons of treated municipal sewage per day are discharged into the waters off Southern California (SCCWRP, 1986). Although greater strides will be made to decrease or at least limit the amount of sewage entering the southern California region, with a projected 50 percent increase in the coastal population by the year 2010 (Section IV.D.1.c), it is assumed that pollution effluents will continue to increase or, at best remain at the present level over the next 35 years.

In the cumulative case, a total of 17 oil spills greater than 1,000 bbl have been hypothesized to occur in the Pacific OCS Region over the 35-year life of the proposal. One pipeline spill (estimated at 7,000 bbl) and one platform spill (estimated at 20,000 bbl) are hypothesized to occur in southern California. Five tanker spills (30,000 bbl each) of Alaska OCS production are estimated to occur along the west coast of the United States. Five TAPS tanker spills and five import tanker spills are also projected to occur along the U.S. west coast between the Canadian and Mexican borders. Tanker spills hypothesized offshore Washington, central California, and southern California are assumed to occur within 80 km (50 miles) of the coastline and contact the shore. Tanker spills offshore Oregon and northern California are assumed to occur more than 80 km at sea and are not expected to contact the coast. For purposes of analysis it is further assumed that the spills will occur with uniform frequency and spatial distribution within each Pacific OCS planning area over the life of the cumulative scenario. No additive effects from multiple spills are expected.

As discussed in the base case, most subsistence gathering occurs relatively close to shore and in close proximity to large urban centers. Therefore, a spill contacting the shoreline has a greater chance of impacting these sites, resulting in impacts ranging from temporary degradation of a few species in the contact area, to the elimination of several important species. The severity of the impact of a spill on regional subsistence activities would depend upon the location and season. However, it is expected that subsistence gathering in the local affected area would be affected for up to a year.

CONCLUSION: The availability or desirability of resources within subsistence gathering areas are expected to decline over the next 35 years. The primary cause of the decline will continue to be human usage and, to a lesser extent domestic and industrial pollution. Accidental oil spills resulting from the proposal and from the transportation of OCS and non-OCS oil are expected to contact intertidal subsistence gathering areas resulting in the loss of the particular gathering area for up to a year.

(13) Impacts on Archaeological Resources

(a) Gulf of Mexico Region

The following analysis considers the effects of trawling; sport diving; commercial treasure hunting; tropical storms; and activities associated with the proposed action, prior, and future OCS sales. Specific types of OCS related impact-producing factors considered in this analysis include drilling rig and platform emplacement, pipeline emplacement, anchoring, oil spills, dredging, new onshore facilities, and ferromagnetic debris associated with OCS hydrocarbon activities. A discussion of each impact-producing factor is presented in Section IV.D.1.c.

HISTORIC: Since likely locations of archaeological sites cannot be delineated without first conducting a remote-sensing survey of the seabed and near-surface sediments, MMS requires that an archaeological survey be conducted prior to development of lease tracts within the high probability zones for historic and prehistoric archaeological resources. The recent MMS study (Garrison et al., 1989) has redefined the high probability zone (ARZ1) for the occurrence of historic period shipwrecks.

Generally, offshore west Texas and in the areas offshore east Louisiana and Mississippi, where unconsolidated sediments are thicker, it is likely that sidescan sonar will not detect shipwrecks buried beneath the mud. In these areas the effectiveness of the survey for detecting historic shipwrecks of composite and wooden construction would depend on the capability of a magnetometer towed at a 50-m line spacing (as specified in the Notice to Lessees (NTL) 91-02) to detect ferromagnetic masses of the size characteristically associated with historic shipwrecks. It is assumed that magnetometer reliability for detecting ferrous objects under these conditions 90 percent. Therefore, offshore west Texas, east Louisiana, and Mississippi, the survey would reduce the potential for an interaction by 90 percent. In Federal waters offshore east Texas, west Louisiana and in the deeper water portions of the gulf off these areas, where shipwrecks are more likely to be detected by sidescan sonar, the potential for a direct physical contact between an impact-producing factor and a shipwreck would be reduced by an estimated 95 percent. The generally thin layer of carbonate sands at the seafloor in the waters offshore Florida would probably allow most shipwrecks to be detected at the required 50 m survey linespacing with side scan sonar and magnetometer. Therefore, the effectiveness of the survey would greatly reduce the potential impact to historic shipwrecks, within these areas of thin sediment veneer.

With regard to non-OCS activities in the Gulf of Mexico, trawling activities would only affect the uppermost portion of the sediment column (Garrison et al,1989). On many wrecks, this zone would already be disturbed by natural factors and would contain only artifacts of low specific gravity which have lost all original contact. Therefore, the effect of trawling on most historic shipwreck sites would be very low.

Sport diving and commercial treasure hunting are significant factors in the loss of historic data from wreck sites. While commercial treasure hunters generally impact wrecks with intrinsic monetary value, sport divers may collect souvenirs from all types of wrecks. Since the extent of these activities is unknown, the impact cannot be quantified. It is assumed that some of the data lost have been significant and/or unique.

Tropical cyclones are yearly occurrences in the Gulf of Mèxico. These storms have impacted all areas of the Gulf from west Texas to south Florida (cf DeWald,1980). Shipwrecks in shallow waters are exposed to a greatly intensified longshore current during tropical storms (Clausen and Arnold,1975). Under such conditions, it is highly likely that artifacts of low specific gravities (e.g. ceramics and glass) would be dispersed. Some of the original information contained in the site would be lost in this process, but a significant amount of information would also remain. Overall, a significant loss of data from historic sites has probably occurred, and will continue to occur, in the Gulf of Mexico, from the effects of tropical storms. It is reasonable to assume that some of the data lost has been unique.

Under the cumulative scenario, future OCS exploration and development activities offshore Texas are expected to result in the drilling of 5,520 new exploration and delineation wells and 2,450 new development wells. It is expected that 150 new platforms will be installed, and that 2,230 miles of offshore pipelines will be laid. Some of these activities will take place within lease blocks not considered to have a high probability for the occurrence of historic period shipwrecks. The location of any proposed activity within a lease block that has a high probability for historic shipwrecks requires archaeological clearance prior to operations. The potential that an interaction between rig, platform, or pipeline emplacement and a historic shipwreck is diminished by the survey, but still exists. This possibility and the possibility of impacts to significant or unique historic archaeological resources prior to the advent of archaeological surveys result in a high probability of an OCS activity contacting and damaging (or having contacted and damaged) a shipwreck. Unique archaeological information contained within a site or resource could be (or has been) destroyed.

In Federal waters offshore east Texas and west Louisiana, where shipwrecks are more likely to be detected by sidescan sonar, the potential for a direct physical contact between an impact-producing factor and a shipwreck would be reduced by an estimated 95 percent, however a small possibility of impact remains. The effectiveness of the survey would greatly reduce the potential impact to historic shipwrecks within these areas, but the possibility of impacts to significant or unique historic archaeological resources prior to the advent of the archaeological resource stipulation (as well as the smaller possibility of a wreck missed in the survey) may result (or have resulted) in the loss of unique archaeological information .

Federal waters offshore Louisiana, Mississippi, and Alabama are expected to have a total of 11,080 new exploration, delineation, and development wells drilled under the cumulative scenario. There are expected to be 340 new platform installations and 3,140 miles of pipelines laid in the area. It is expected that some of these OCS program activities will occur within lease blocks not considered to have a high probability for historic shipwrecks. Under current survey requirements, as much as 10 percent of activities within lease blocks offshore east Louisiana and Mississippi, considered to have a high probability for shipwrecks would occur without accurate information about the proximity of the activity to an historic resource. The location of any proposed activity within a lease block that has a high probability for historic shipwrecks requires archaeological clearance prior to operations. The potential that an interaction between rig, platform, or pipeline emplacement and a historic shipwreck is greatly diminished by the survey, but still exists. This possibility and the possibility of impacts to significant or unique historic archaeological resources prior to the advent of archaeological surveys result in a high probability of an OCS activity contacting and damaging (or having contacted and damaged) a shipwreck. Unique archaeological information contained within a site or resource could be (or has been) destroyed. In Federal waters offshore west Louisiana and Alabama, where shipwrecks are more likely to be detected by sidescan sonar, the potential for a direct physical contact between an impact-producing factor and a shipwreck would be reduced by an estimated 95 percent. The effectiveness of the survey would greatly reduce the potential impact to historic shipwrecks in these areas, but the possibility of impacts to significant or unique historic archaeological resources prior to the advent of the archaeological resource stipulation (as well as the smaller possibility of a wreck missed in the survey) may result (or have resulted) in unique archaeological information being damaged or destroyed.

Federal waters offshore Florida are expected to have a total of 780 new exploration, delineation, and development wells drilled. There are expected to be 28 platform installations and 545 miles of pipelines laid in the area under the cumulative scenario. It is expected that some of these OCS Program Activities will occur within lease blocks not considered to have a high probability for historic shipwrecks. The generally thin layer of carbonate sands at the seafloor in the waters offshore Florida would probably allow most shipwrecks to be detected at the required 50 m survey linespacing with side scan sonar and magnetometer. The location of any proposed activity within a lease block that has a high probability for historic shipwrecks requires archaeological clearance prior to operations. The effectiveness of the survey would greatly reduce the potential impact to historic shipwrecks in these areas, but the possibility of impacts to significant or unique historic archaeological resources prior to the advent of the archaeological resource stipulation (as well as the smaller possibility of a wreck missed in the survey) may result (or have resulted) in unique archaeological information being damaged or destroyed.

The setting of anchors for drilling rigs, platforms, pipeline lay barges, and anchoring associated with oil and gas vessel trips to the OCS has the potential to impact historic wrecks. The archaeological surveys serve to minimize the chance of impacting historic wrecks, however these surveys are not seen as infallible and the chance of an impact from future activities exists. A total of 154,761 shuttle tanker, barge, and service vessel trips are assumed for Federal waters offshore Texas (USDOI, MMS 1991c Table IV-13). A total of 361,271 shuttle tanker, barge, and service vessel trips are assumed for Federal waters offshore Louisiana, Mississippi, and Alabama. A total of 32,424 shuttle tanker, barge, and service vessel trips are assumed for Federal waters offshore Florida (USDOI, MMS, 1990b Table IV-10). The potential that an impact from anchoring and an historic shipwreck either has or will occur is unknown. However, such an interaction could result in the loss of significant or unique information.

Onshore historic properties include: sites, structures, and objects such as historic buildings, forts, lighthouses, homesteads, cemeteries, and battlefields. Sites already listed on the National Register of Historic Places and those considered eligible for the Register have already been evaluated as being able to make a unique or significant contribution to science. At present, unidentified historic sites may contain unique historic information and would have to be assessed after discovery to determine their significance.

Onshore development as a result of the proposed action could result in the direct physical contact between the construction of new onshore facilities or pipeline canals and previously unidentified historic sites. This direct physical contact with an historic site could cause physical damage to, or complete destruction of, information on the history of the region and the Nation. Four pipeline landfalls and four terminals are projected for Texas under the cumulative scenario. It is assumed that the terminals would impact between 28 ha and 96 ha of land, and that there would be 160 km of onshore pipelines. In the coastal areas of Louisiana, Mississippi, and Alabama two terminals, one pipeyard, and 4 pipeline landfalls are expected. It is assumed that these activities would impact between 26 ha and 60 ha of land, and would result in 160 km of onshore pipelines. No onshore infrastructure facilities are expected in the coastal areas of Florida. State and Federal laws require consideration of historic properties if any State or Federal funding or permits are required for construction. Therefore, there is little to no expected impact to coastal historic properties as a result of these activities.

Most channel dredging occurs at the entrances to bays, harbors, and ports. These areas have a high probability for historic shipwrecks, and the greatest concentrations of historic wrecks are likely associated with these features (cf. Garrison et al,1989). Assuming that some of the data lost have been unique, the impact to historic sites as a result of past channel dredging activities would be very high. In many areas, the Corps of Engineers requires remote sensing surveys prior to dredging activities to minimize such impacts (Espey, Huston, & Associates, 1990) .

Past, present, and future oil and gas exploration and development on the OCS will result in the deposition of tons of ferromagnetic debris on the seafloor. This modern marine debris will tend to mask the magnetic signatures of historic shipwrecks, particularly in areas which were developed prior to requiring archaeological surveys. Such masking of the signatures characteristic of historic shipwrecks may have resulted in OCS activities impacting a shipwreck containing significant or unique historic information.

Oil spills resulting from the OCS program and import tankering have been described earlier under Impactt on Gulf of Mexico Water Quality and Marine Mammals (Section IV.D.1.c(1) and IV.D.1.c(3)). That description includes assumptions of oil spill occurrence, spill sizes, and likely contacts with shoreline and wetlands areas. (Section IV.D.c(1)). That description includes assumptions regarding oil spill occurrence, source, and size. The impacts caused by oil spills to coastal historic archaeological resources are generally limited in scope to a period of weeks and are reversible.

In summary, several impact-producing factors may threaten historic archaeological resources under the cumulative scenario. It is expected that significant or unique historic archaeological information has been damaged or destroyed due to effects from dredging, sport diving, commercial treasure hunting, and tropical storms. Impacts could result from a contact between an OCS activity (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) and an historic shipwreck located on the continental shelf. The archaeological surveys and resulting archaeological analysis and clearance that are required prior to an operator beginning oil and gas activities in a lease block are estimated to be 90 percent effective at identifying possible historic shipwrecks in areas with a thick blanket of underconsolidated sediments (west Texas and east Louisiana/Mississippi). The surveys are estimated to be 95 percent effective in other areas of the Gulf. Development of the Gulf prior to requiring archaeological surveys has possibly impacted wrecks containing significant or unique historic information. The loss or toss of tons of ferromagnetic debris associated with oil and gas exploration and development could result in the masking of historic shipwrecks. The cumulative effect of this factor may result in the masking of a historic wreck.

Onshore development as a result of the proposed action could result in the direct physical contact between a historic site and new facility construction and pipeline trenching. It is assumed that archaeological investigations prior to construction will serve to mitigate these potential impacts. There is a possibility of loss of significant or unique historic archaeological information from such activity prior to the advent of Federal and State laws requiring protection of archaeological resources. While the likelihood of an oil spill occurring and contacting the coastline is high, expected impacts on historic coastal resources are estimated to be restricted to a period of weeks. Expected impacts from commercial fisheries (trawling) are estimated to be minor.

PREHISTORIC: The cumulative total of offshore development analyzed under the cumulative scenario greatly increases the potential for an interaction between an impact-producing factor and a prehistoric site. Should an interaction occur, the potential exists for the loss of significant or unique archaeological information.

Offshore development could result in an interaction between a drilling rig, platform, pipeline, dredging, or anchors and an inundated prehistoric site. This direct physical contact with a site could destroy fragile artifacts or site features and could disturb artifact provenance and site stratigraphy. The result would be the loss of archaeological data on prehistoric migrations, settlement patterns, subsistence strategies, and archaeological contacts for North America, Central America, South America, and the Caribbean.

Likely locations for archaeological sites can be delineated with high-resolution seismic data. As the high probability zone for the occurrence of prehistoric sites on the OCS approximates the 45 m bathymetric contour, deeper water areas of the Gulf are considered to have a very low probability for prehistoric archaeological sites. The archaeological surveys coupled with archaeological analysis and clearance of proposed location of operations are estimated to be 90 percent effective in allowing identification and avoidance of high probability areas for site occurrence.

Most channel dredging occurs at the entrances to bays, harbors, and ports. These areas have a high probability for prehistoric archaeological sites as they are associated with geomorphic features known to have a high probability for prehistoric sites (CEI,1977). It is assumed that some of the data lost as a result of dredging have been unique. In many areas, the Corps of Engineers requires remote sensing surveys prior to dredging activities to minimize such impacts (cf. Espey, Huston, & Associates,1990).

Trawling activity in the Gulf would only affect the uppermost portion of the sediment column (Garrison et al,1989). This zone would already be disturbed by natural factors relating to the destructive effects of marine transgression and continuing effects of wave and current action. Therefore, the effect of trawling on most prehistoric archaeological sites would be minimal.

Tropical cyclones are yearly occurrences in the Gulf of Mexico. These storms have impacted all areas of the Gulf from west Texas to south Florida (cf DeWald,1980). Prehistoric sites in shallow waters, or coastal beach sites are exposed to the destructive effects of wave action and scouring currents during these events. Under such conditions, it is highly likely that artifacts would be dispersed and the site context disturbed. Some of the original information contained in the site would be lost in this process. Overall, a significant loss of data from prehistoric sites has probably occurred, and will continue to occur, from the effects of tropical storms. It is assumed that some of the data lost have been significant and/or unique.

It is assumed that 63 oil spills (greater than or equal to 1,000 bbl) will occur from import tankering in the Gulf of Mexico during the life of the proposal. Two such spills would result from tankering crude oil from the TAP into the Gulf. The probability of one or more import tanker spills greater than or equal to 1,000 bbl occurring in the Gulf of Mexico is 99.5 percent. The average size of an import tanker spill is estimated at 30,000 bbl. Of the import spills estimated, 31 are estimated to occur in nearshore waters and 21 in port areas within the northwestern (Texas) and northcentral (primarily Louisiana) Gulf of Mexico. Port areas expected to receive the greatest number of these spills include Houston/Galveston, the Louisiana Offshore Oil Port (LOOP), and Mississippi River ports. No ports within the northeastern Gulf (Florida) presently receive crude oil imports for refining; therefore, no import crude spills are assumed to occur in Florida port areas.

Under the cumulative scenario, future OCS exploration and development activities offshore Texas are expected to result in the drilling of 5,520 new exploration and delineation wells and 2,450 new development wells. It is expected that 150 new platforms will be installed, and that 2,230 miles of offshore pipelines will be laid. Some of these OCS program activities will occur within lease blocks considered to have a low probability for prehistoric sites. The potential that an interaction between a rig, platform, or pipeline emplacement and a prehistoric site is diminished by the survey, but still exists. It is assumed that major impacts to prehistoric resources resulted from development prior to the advent of the archaeological resource surveys. Such interaction could result (or has resulted) in the loss of significant or unique prehistoric information.

Federal waters offshore Louisiana, Mississippi, and Alabama are expected to have a total of 11,080 new exploration, delineation, and development wells drilled under the cumulative scenario. There are expected to be 340 new platform installations and 3,140 miles of pipelines laid in the area. It is expected that some of these OCS program activities will occur within lease blocks considered to have a low probability for prehistoric archaeological sites. The potential that an interaction between a rig, platform, or pipeline emplacement and a prehistoric site is diminished by the survey, but still exists. It is assumed that major impacts to prehistoric resources resulted from development prior to the advent of the archaeological resource surveys. Such interaction could result (or has resulted) in the loss of significant or unique prehistoric information.

Federal waters offshore Florida are expected to have a total of 780 new exploration, delineation, and development wells drilled. There are expected to be 28 platform installations and 545 miles of pipelines laid in the area under the cumulative scenario. It is expected that some of these OCS program activities will occur within lease blocks considered to have a low probability for prehistoric archaeological sites. Deferral zones off of the west coast of Florida and south of 26 degrees latitude are currently in place and eliminate many of the blocks considered to have a high probability for prehistoric sites from possible OCS program activities. The potential that an interaction between a rig, platform, or pipeline emplacement and a prehistoric site is diminished by the survey, but still exists. It is assumed that major impacts to prehistoric resources resulted from development prior to the advent of the archaeological resource surveys. Such interaction could result (or has resulted) in the loss of significant or unique prehistoric information.

The setting of anchors for drilling rigs, platforms, pipeline lay barges, and anchoring associated with oil and gas vessel trips to the OCS has the potential to impact shallowly emplaced prehistoric sites. The archaeological surveys serve to minimize the chance of impacting historic wrecks, however these surveys are not seen as infallible and the chance of an impact from future activities exists. A total of 154,761 shuttle tanker, barge, and service vessel trips are assumed for Federal waters offshore Texas (USDOI, MMS, 1991c Table IV-13). A total of 361,271 shuttle tanker, barge, and service vessel trips are assumed for Federal waters offshore Louisiana, Mississippi, and Alabama. A total of 32,424 shuttle tanker, barge, and service vessel trips are assumed for Federal waters offshore Florida (USDOI, MMS, 1990b Table IV-10). The potential that an impact from anchoring and an prehistoric site either has or will occur is unknown. However, such an interaction could result in the loss of significant or unique information.

Onshore development as a result of the proposed action could result in direct physical contact between the construction of new onshore facilities or pipeline canals and previously unidentified prehistoric sites. This direct physical contact with a prehistoric site could cause physical damage to, or complete destruction of, information on the prehistory of the region and the Nation. Four pipeline landfalls and four terminals are projected for Texas under the cumulative scenario. It is assumed that the terminals would impact between 28 ha and 96 ha of land, and that there would be 160 km of onshore pipelines. In the coastal areas of Louisiana, Mississippi, and Alabama two terminals, one pipeyard, and 4 pipeline landfalls are expected. It is assumed that these activities would impact between 26 ha and 60 ha of land, and would result in 160 km of onshore pipelines. No onshore infrastructure facilities are expected in the coastal areas of Florida. State and Federal laws require consideration of potential prehistoric sites if any State or Federal funding or permits are required for construction. Therefore, there is little to no expected impact to coastal prehistoric sites as a result of these activities.

Under the cumulative scenario, it is assumed that ten oil spills greater than or equal to 1,000 bbl would occur from program-related activities Gulfwide. Two oil spills (one 20,000 bbl platform spill and one 25,000 bbl pipeline spill) would occur offshore Texas, seven spills (three 20,000 bbl platform spills and four 25,000 bbl pipeline spills) would occur in the northcentral Gulf offshore Louisiana/Mississippi/Alabama, and one 25,000-bbl pipeline spill would occur in the northeastern Gulf offshore Florida. Based on a 20 percent chance of coastal contact from these spills (pipeline or platform), it is assumed that two spills will contact the Gulf coast. As described under the base case, considering the location of oil pipelines and platforms offshore, and the pattern of coastal ocean currents, the most likely location for contact from one of these spills is along a stretch of coast extending from western Louisiana to eastern Texas. A second spill, originating in the northeastern Gulf offshore Florida, is assumed to occur along the Mississippi/Alabama coast (Gulf Islands National Seashore) and within the Mississippi Sound area. For both spills, it is assumed that as much as 75 percent of the original volume of oil from the spill source will be lost as a result of weathering processes by the time the slick contacts the coast. It is further assumed that 37 oil spills (greater than 50 bbl and less than 1,000 bbl) and 985 oil spills (greater than 1 bbl and less than or equal to 50 bbl) could occur from OCS pipeline, platform, and transportation sources Gulfwide. Of these, it is assumed that fewer than 50 spills (greater than 1 bbl and less than or equal to 50 bbl) are assumed to contact the coast. An additional 152 spills (less than 50 bbl) are assumed to occur from onshore support activities.

Should an oil spill contact a coastal prehistoric site, the potential for dating the site using C^{14} could be destroyed. This loss of information might be ameliorated by ceramic or lithic seriation or other relative dating techniques. Previously unrecorded coastal sites could also experience an impact from oil-spill cleanup operations. Cleanup equipment could destroy fragile artifacts or site features and could disturb the site context. The result would be the loss of information on the prehistory of North America and the Gulf Coast Region. Some of the coastal prehistoric sites that might be impacted by beach cleanup operations may contain unique information. In coastal areas of the Gulf, prehistoric sites occur frequently along the barrier islands and mainland coast and the margins of bays and bayous. Thus, any spill that contacts the land would involve a potential impact to a prehistoric site. Prehistoric archaeological sites, some dating between the earliest period of human occupation of the Gulf of Mexico and the time of European contact, have been recorded in the near coastal plain of southwestern Louisiana the northeast coast of Texas (cf Aten,1983). Shallowly inundated, Archaic period sites have been recorded in the near shore waters off Florida. Damage or loss of unique and/or significant archaeological information could result from the contact between an oil spill and a prehistoric archaeological site.

In summary, several impact-producing factors may threaten the prehistoric archaeological resources of the Gulf. It is estimated that significant or unique archaeological information has been lost due to impacts from dredging and from tropical storms. There are no significant expected impacts from commercial fisheries (trawling). Impacts could result from a contact between an OCS activity (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) and a prehistoric site located on the continental shelf. The archaeological surveys and archaeological clearance of sites that are required prior to an operator beginning oil and gas activities in a lease block are estimated to be 90 percent effective at identifying possible prehistoric sites. These surveys diminish the potential for contact between an OCS program activity and a prehistoric site, however there remains a possibility for such contact. Should such a contact occur, unique or significant archaeological information could be lost.

Onshore development as a result of the cumulative scenario could result in the direct physical contact between new facility construction, pipeline trenching, or navigation canal dredging and a prehistoric archaeological site. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. Impacts to prehistoric sites from such activities prior to the inaction of State and Federal protective laws may have resulted in the loss of significant or unique archaeological information.

Should an oil spill contact a coastal prehistoric site, the potential for dating the site using radiocarbon methods could be destroyed. Oil spill cleanup operations could physically impact coastal prehistoric sites. Previously unrecorded sites could also experience an impact from oil-spill cleanup operations on beaches. Under the cumulative scenario, there is a high probability for contact between a large oil spill and a coastal prehistoric site. Should such contact occur, unique or significant archaeological information could be lost.

CONCLUSION: Under the cumulative scenario, it is expected that many (more than 10) prehistoric archaeological sites or historic sites containing significant but not unique information have been or would be disturbed to an extent that the sites lose at least one physical feature which would yield scientific information. The incremental contribution of the proposal is expected to be very small due to the efficacy of the remote-sensing survey and required archaeological clearance.

(b) Alaska Region

Non-OCS impact-producing agents (IPA's) would be State oil and gas lease sales and private industries developing from them. Any pipeline activities or facility activities could affect archaeological resources. Cumulative effects on archaeological resources are caused by similar IPA's to those given in the cumulative scenario for State and private mining and oil activities in Section IV.D.1.c.

In the offshore arctic region, which includes the Beaufort and Chukchi Seas, 5.43 Bbbl are expected to be produced by 72 exploration and development wells and 723 development and production wells by drilling from 12 platforms. The onshore infrastructure includes 12 platforms and one shore base. The major actions affecting Bering Sea archaeological resources are the activities discussed briefly in Section IV.D.1.c and are mostly associated with Federal and State oil and gas lease sales. Archaeological resources would be affected by OCS populations and activities in the Beaufort and Chukchi areas. There are discussions of cultural resources in the USDOI, MMS (1982a; 1983e; 1985b). Anticipated exploration and production infrastructure for the Navarin, St. George, and North Aleutian Basin (low probability of all three happening) could affect archaeological resources in the area. In the offshore Bering Region, 1.37 Bbbl are expected to be produced by 37 exploration and development wells and 300 development and production wells by drilling from six platforms. The onshore infrastructure includes three shore bases. The Gulf of Alaska onshore infrastructure includes two shore bases. In the offshore Gulf of Alaska Region, 0.85 Bbbl are expected to be produced by 24 exploration and development wells and 140 development and production wells by drilling from three platforms.

Routine OCS IPA's such as the drilling of exploratory and production wells, laying pipelines, and the construction on onshore facilities and the maintenance of such are assumed to cause little or no disturbance to archaeological resources because archaeological surveys are required prior to permitting Federal activities in areas assessed as having potential for archaeological site occurrence.

Accidental oil spills would have the greatest impact on nearshore and coastal historic and prehistoric archaeological sites. Should an oil spill contact a coastal historic site, the major impact would be visual due to oil contamination of the site and its environment. This impact would most likely be temporary, lasting up to several weeks depending on the time required for cleanup.

Should an oil spill contact a prehistoric site, the potential for dating the site using C^{14} could be destroyed. This loss of information might be ameliorated by the use of other, relative dating techniques. Unrecorded coastal sites could also experience an impact from oil-spill cleanup operations. Cleanup equipment could destroy fragile artifacts or site features and could disturb the site context. Any spill that contacts land would involve a potential impact to prehistoric sites.

Population levels would increase in Unalaska and Cold Bay, which are support-base sites. These population increases could affect archaeological resources. For example, exploration and development personnel whose families live in Anchorage may want to seek hunting and fishing experiences in the northern Aleutian coastal area while recreating with their families. Such visitors would increase the probability of interaction with archaeological resources, e.g., World War II sites onshore. These cumulative types of effects could occur in the vicinity of the cities of Cold Bay and Unalaska. The remaining coastal area surrounding the North Aleutian Area would primarily be unaffected.

Accidental OCS IPA's such as spilled oil would affect resources onshore during spill and cleanup of the spill and rarely archaeological resources offshore in the depths of the bottom. Non-OCS IPA's are assumed to produce physical alteration or destruction of complete sites or site components may result in the loss of archaeological data on prehistoric migration, settlement patterns, subsistence strategies, and cultural contacts. Routine OCS IPA's such as predevelopment seismic surveying and bottom sampling may result in identification of previously unknown sites thus providing a benefit to archaeological research. On the other hand, bottom sampling also could result in the disturbance of buried resources. Because archaeological interpretation is heavily dependent on the relative placement of artifacts within a site, such disturbances could be very damaging. Rig and platform installation could disturb both surface and buried resources. Drilling muds, cuttings, and fluids may damage sites by means of chemical activity but also could afford protection by burying the site. Based on information obtained from predrilling surveys, lessees would be able to take actions that would avoid or lessen many potentially negative impacts on prehistoric archaeological resources. Accidental OCS IPA's such as oil spills could severely affect prehistoric sites located in tidally influenced areas. Oil could destroy C^{14} dating potential of a site; oil-spill-cleanup operations could disturb or destroy site context.

Because of the low probability of the presence of archaeological resources in the Navarin Basin, cumulative OCS activities would have very little effect on archaeological resources. When Federal projects in other more northern lease areas occur, increased tanker, workboat, and aircraft traffic would result. This increased activity and population would increase the risk of damage to cultural resources because significant contacts could occur at the Unimak Pass blocks and/or at locations of support and development facilities near Herendeen and Balboa Bays. State sales in the Kuskokwim (southwest Bristol Bay uplands) also could affect cultural resources. Except for some increased tankering through Unimak Pass or from Balboa Bay, cumulative activities will remain low for the Shumagin area and, as a result, any disturbed archaeological site will retain a majority of its features that give it scientific integrity. The cumulative overall change due to the non-OCS and OCS activities listed in Section IV.D.1.c on Bering Sea archaeological resources is expected to disturb few resources.

CONCLUSION: Under the cumulative scenario, it is expected that some impact will occur to coastal historic and prehistoric archaeological resources in the Alaska Region. Existing State and Federal regulations require archaeological surveys to be conducted prior to permitting any activity that might disturb a significant archaeological site. Because of these in-place protective measures, it is expected that few, if any, historic or prehistoric sites would be disturbed as a result of OCS IPAs. Impacts will primarily result from increased human interaction with coastal sites and from accidental oil spills. Although it is not possible to predict the precise number of types of sites that would be affected (it is estimated up to five will be affected), it is expected that the proposal and related oil spill activities will affect at least one site, and a small amount of significant archaeological information will be lost.

(c) Pacific Region

Impacts to offshore archaeological resources could occur as a result of the actual physical destruction of an artifact, disruption of the horizontal and vertical matrix in which the archaeological resource occurs, and contamination of the organic site material with hydrocarbons, which could destroy the C^{14} dating potential of the material (see Section IV.D.1.c). In addition to OCS activities hypothesized for the proposed action, the principal sources of cumulative impacts to offshore archaeological resources in the Pacific OCS Region are existing and future oil and gas activities on the OCS and in State waters, existing oil and gas infrastructure, major harbor projects, and Alaskan and foreign import tankering.

There are 23 platforms in place in the Pacific OCS Region at present, including three platforms awaiting start up and two platform jackets. Ten additional platforms are projected to be installed on existing leases over the life of the proposed program. Seven platforms are hypothesized to be installed as a result of this proposal. A total of 21 platforms are expected to be removed from the OCS over the 35 year life of the proposal.

A total of 8 platforms and 6 artificial islands are in place in State waters, and are producing hydrocarbons. No additional offshore oil and gas facilities are anticipated in State waters. No new onshore facilities will be constructed to support hydrocarbon development from blocks included in the proposed leasing schedule. Oil and gas processing will occur at existing or currently planned sites. Consequently, no onshore archaeological sites will be disturbed.

Platform installation could affect archaeological resources by inserting a structure into a 0.8 km^2 (0.3 mi^2) area which had previously been undisturbed open water. The area displaced by all existing and projected platforms could total 38.4 km^2 (14.8 mi^2), an extremely small area in relation to the total area of the planning area. It is also assumed that one pipeline from an existing lease will be constructed to a shoreline landfall in the northern Santa Maria Basin. Potential impacts associated with offshore pipeline construction include bottom disturbance along the corridor up to the landfall.

These impacts will be limited to the immediate vicinity of the pipeline project. However, prior to the initiation of drilling operations or pipeline installation operations, remote sensing surveys are conducted at prospective well sites and along pipeline corridors. The results of these surveys are used to identify and avoid any anomalies that may represent archaeological resources. Any site discovered during operations will be reported, and the operator will be required to follow directions from MMS and given procedures to follow in order to protect the resource. Therefore, normal operations including platform installation and removal, are not expected to result in measurable effects on archaeological resources in the planning area.

A major harbor project, targeted for the year 2020, has been proposed for the Los Angeles/Long Beach harbor area. This project calls for the improvement of existing harbor facilities and the construction of new port facilities. The project could cause impacts to any unidentified archaeological resource in the vicinity of construction activities due to dredging and construction operations. This potential risk will continue for the duration of the construction phase of the project. However, as discussed above for OCS construction activities, it is assumed that remote sensing surveys will be initiated prior to any dredging or construction activities. Impacts to archaeological resources in the harbor area are not expected.

In the cumulative case, a total of 17 oil spills greater than 1,000 bbl have been hypothesized to occur in the Pacific OCS Region over the 35-year life of the proposal. One pipeline spill (estimated at 7,000 bbl) and one platform spill (estimated at 20,000 bbl) are hypothesized to occur in southern California. Five tanker spills (30,000 bbl each) of Alaska OCS production are estimated to occur along the west coast of the United States. Five TAPS tanker spills and five import tanker spills are also projected to occur along the U.S. west coast between the Canadian and Mexican borders. Tanker spills hypothesized offshore Washington, central California, and southern California are assumed to occur within 80 km (50 miles) of the coastline and contact the shore. Tanker spills offshore Oregon and northern California are assumed to occur more than 80 km at sea and are not expected to contact the coast. For purposes of analysis it is further assumed that the spills will occur with uniform frequency and spatial distribution within each Pacific OCS planning area over the life of the cumulative scenario. No additive effects from multiple spills are expected.

As discussed in the base case, although there are some historic shipwrecks in federal waters, most archaeological sites are relatively close to shore. Therefore, a spill contacting the shoreline has a greater chance of impacting these sites, resulting in a temporary degradation of the viewshed of any historic or prehistoric sites in the contact area. The effects would last for the duration of the spill and the period necessary for cleanup activities (approximately 2 months). Submerged sites would not be expected to be impacted by an oil spill unless the oil sinks and settles to the bottom, coating any artifacts that may be present. Overall, due to potential for reduction by weathering, wave action, and containment activities, accidental large oil spills are expected to result in a negligible loss of scientific information from archaeological resources. The crisis atmosphere during a spill cleanup period could result in accidental damage and/or total destruction of unidentified sites. The level of damage would depend on the amount of information lost at any particular site. Careful coordination during cleanup operations would provide a measure of protection for this resource. However, the loss of some scientific information to nearshore archaeological sites contacted is expected. Closure of the site would be expected for a few weeks to one month.

CONCLUSION: The greatest cumulative effects on offshore archaeological resources are expected to occur as a consequence of accidental oil spills resulting from the transportation of OCS and non-OCS oil. These effects include potential destruction of nearshore archaeological sites contacted by the spill, and would be due to cleanup activities as a result of the spill.

(d) Atlantic Region

PREHISTORIC: The existing conditions of the Atlantic prehistoric resources are described in Section III.C.3.c. Non-OCS routine activities and natural phenomenon that are assumed to impact these resources under this scenario are commercial and residential development, trawling, sport diving, commercial treasure hunting, channel dredging, and rising sea level. Routine OCS activities assumed for this cumulative-case scenario that could affect these resources are bottom-disturbing pipelaying and drilling activities. Accidents assumed for this scenario that could affect prehistoric resources include large and small oil spills from existing tanker transport from foreign imports and small spills from OCS activities (most of which are expected to occur offshore).

Construction of OCS and non-OCS-related onshore facilities (i.e., commercial and residential development) could result in prehistoric sites being damaged or destroyed. However, these impacts would be mitigated through compliance with a variety of Federal permitting requirements and the requirements of the Coastal Zone Management Programs of the affected States. Because trawling by fishermen affects only the uppermost portion of sediments, the risk to prehistoric sites would be low. The zone disturbed from fishing also would have been affected to some extent by natural forces. Therefore, fishing is expected to have a limited impact. Sport and commercial diving also are expected to have little effect on prehistoric sites. Since most channel dredging takes place near the entrance to inlets and ports, both prehistoric sites and historic shipwrecks could be severely affected because ports and harbors were areas of concentrated cultural activity in both historic and prehistoric times. Transgressing seas from sea level rise erodes the shoreline exposing prehistoric sites. These sites often become so physically and chemically altered that they contain little information of any value.

The greatest possibility of impact to prehistoric resources from human activities expected to be from oil spill cleanup activities at the shoreline. As explained in Section IV.D.1.a(13), heavy machinery could destroy prehistoric sites while removing oiled sediments. As noted above all of these spills are assumed to be from foreign imports. Small chronic spills that could occur during supply vessel refueling typically weather or are cleaned up before they have a chance to contaminate prehistoric sites and are not expected to affect these resources.

HISTORIC RESOURCES: The existing conditions of the Atlantic historic resources are described in Section III.C.3.c. Non-OCS and OCS routine activities and accidents that are assumed to impact these resources for this scenario are the same as those listed above for prehistoric resources.

Construction of OCS and non-OCS-related onshore facilities (i.e., commercial and residential development) could result in historic resources being damaged or destroyed. As noted above, compliance with a variety of Federal permitting requirements and the requirements of the Coastal Zone Management Programs of the affected States would mitigate these impacts. Trawling affects only the uppermost portion of sediments and is expected to have a limited impact on historic shipwrecks. Channel dredging affects a deeper layer of sediments than trawling and has therefore a greater potential to affect historic shipwrecks. However, most dredging activities are subject to U.S. Army Corps of Engineers remote sensing survey requirements which can mitigate impacts. Sport diving and commercial treasure salvage can be extremely damaging to historic shipwrecks. By removing artifacts and damaging vessel integrity to locate artifacts of commercial value, much of the information contained in a shipwreck can by destroyed. These two activities are expected to be the most damaging to historic shipwrecks.

As explained in Section IV.D.1.a(13), historic resources located in the proximity of potential oil spill locations are not expected to be affected since they are typically either protected by seawalls or other barriers, or damaged from wave activity to the extent that most of the historic information that previously existed is already destroyed.

In summary, several prehistoric sites are expected to be altered to the point of loosing most of the information they contain. This impact is expected to be mostly attributable to erosion from rising sea level. Cleanup activities for foreign import spills are expected to also contribute to this loss. Tens of historic shipwrecks are expected to loose important artifacts from commercial and sport diver looting. In a few cases the ship remains are expected to be altered such that all of the valuable information is lost. OCS activities are expected to contribute very little to the loss of archaeological information. No prehistoric sites are expected to be contacted by OCS activities and only about one shipwreck is expected to be contacted. "Chance find" provisions of the archaeological site are expected to preserve much of the valuable information.

CONCLUSION: Impacts that are expected under the cumulative scenario for the proposed action are the alteration of several prehistoric sites and historic shipwrecks. Both resources are expected to loose valuable data; some information is expected to be recoverable. Only one of the shipwreck alterations is expected to stem from OCS activities; much of the valuable information of this wreck is expected to be returned.

(14) Impacts on Recreation and Tourism

(a) Gulf of Mexico Region

The major impact producing factors that could potentially affect recreation and tourism include offshore structures, pipeline emplacements, support services (helicopter and vessel traffic), trash and debris and oil spills.

In addition to the 168 platforms expected for installation in the Gulf of Mexico from the proposed action, another 518 are expected to result from lease sales held in the recent past. A total of 3,760 platforms currently exist in Federal waters of the Gulf of Mexico and most of these are off the coast of Louisiana and Texas. Approximately 1,000 additional oil and gas structures exist in state waters off the coasts of Louisiana and Texas. These structures function as artificial reefs and attract fish and fishermen, especially in nearshore waters where they are most accessible to offshore fishermen. In the northcentral and northwestern Gulf new platforms will replace some of the expected removals in the areas where several thousand existing petroleum structures are currently a common focus of marine recreational fishing. However, by the year 2036, approximately 3,100 platforms are expected to have been removed from federal waters offshore Louisiana and Texas, leaving less than 1,000 active production platforms in Federal waters throughout the Gulf. It is expected that some of the retired gas and oil platforms will be acquired by the Gulf states for construction of artificial reefs. Both private boat recreational fishermen and charter boats (tourists) which fish in the Gulf frequently target their efforts near gas and oil platforms when these structures are in the scope of their fishing range. Petroleum structures placed in nearshore lease tracts within 10 miles of coastal beach parks and wilderness areas may disturb ocean views and the enjoyment of beach users opposed to OCS leasing, but should have no affect on level of recreation and tourism visits.

Besides offshore platform development, eight new pipeline landfalls are expected under the cumulative scenario. Likely locations for these landfalls are the Mobile, Alabama, and Pascagoula, Mississippi areas, the mouth of the Mississippi River, and the south Texas coast. Construction of pipeline landfalls across recreational beaches will remove 1,200-1,600 ft of beach from recreational use during the construction period (2-3 weeks). It is likely that two of these landfalls will intersect major recreational beaches. A beach at Gulf Shores, Alabama and another at Padre Island National Seashore are assumed to be impacted by pipeline construction. Pipeline landfalls are preplanned construction operations which can be scheduled during low use visitation periods and are unlikely to affect overall beach use in any park or recreation area affected. Construction will however, remove 1,200-1,600 ft of beach area from recreational use for 2-3 weeks.

Over the next 45 years transportation of men, equipment and supplies to offshore gas and oil operations will result in over 10 million helicopter trips and 6 million trips by service vessels. Noise and boat wakes associated with petroleum transportation operations in conjunction with other commercial, recreational and industrial transportation activities ongoing in the Gulf will cause intermittent disturbance to the ambience of some coastal recreational experiences but is unlikely to affect the number of visitors at coastal park and recreation areas.

Under the cumulative scenario, it is estimated that ten oil spills greater than or equal to 1,000 bbl would occur from program-related activities Gulfwide. Two oil spills (one 20,000-bbl platform spill and one 25,000-bbl pipeline spill) would occur offshore Texas, seven oil spills (three 20,000-bbl platform spills and four 25,000-bbl pipeline spills) would occur in the northcentral Gulf offshore

Louisiana/Mississippi/Alabama, and one 25,000-bbl pipeline spill would occur in the northeastern Gulf offshore Florida. Based on a 20 percent chance of coastal contact from these spills (pipeline or platform), it is assumed that two spills will contact the Gulf coast. As described under the base case, considering the locations of oil pipelines and platforms offshore, and the pattern of coastal ocean currents, the most likely location for contact from one of these spills is along a stretch of coast extending from western Louisiana to eastern Texas. A second spill, originating in the northeastern Gulf offshore Florida, is assumed to contact the Mississippi/Alabama coast. Because of the prevailing currents offshore northwest Florida, no spill (1,000 bbl or greater) contacts are assumed for the northwest Florida coast, but rather contact is assumed to occur along the Mississippi/Alabama coast (Gulf Islands National Seashore) and within the Mississippi Sound area. For both spills, it is assumed that as much as 75 percent of the original volume of oil from the spill source will be lost as a result of weathering processes by the time the slick contacts the coast. It should be noted that there could be some effects from residual weathered oil should it reach coastal waters following a large spill event, primarily in the form of tar material.

Furthermore, it is estimated that 63 oil spills greater than or equal to 1,000 bbl will occur from import tankering in the Gulf of Mexico during the life of the proposal. Two such spills would result from tankering into the Gulf, crude oil from the TAP. The average size of an import tanker spill is estimated at 30,000 bbl. It is estimated that 10 import spills will occur and contact recreational beaches and parks in the Louisiana/Texas/Mississippi coastal areas over the 45-year life of this project. An additional 169 petroleum product spills (11,000 bbl in size) will occur Gulfwide from similar sources. Most of these will occur along the GIWW or in commercial and industrial port areas where they will have no impact on recreation and tourism, however up to 5 such spills are assumed to occur in proximity to recreational beaches and coastal parks and come ashore. It is further estimated that about 1,000 small spills of which 37 are between 50-1,000 bbl and the rest are smaller than 50 bbl could occur from OCS pipelines, platforms, and transportation sources Gulfwide. Of these, it is assumed that fewer than 50 spills (greater than 1 bbl and less than or equal to 50 bbl) and 7 spills (greater than 50 bbl and less than 1,000 bbl) would contact coastal beaches over the next 45 years.

Based on the assumptions stated above 17 major pollution events will occur and directly impact coastal park and recreation areas over the next 45 years, and two of those events are expected to result from gas and oil operations associated with the proposed program. As established in the scenarios presented above major park and recreation areas such as Gulf Islands National Seashore, Grand Isle State Park, or Galveston Island beaches will be impacted from the resulting pollution leading to closure of these parks and beaches during cleanup operations which can last from two to six weeks. As was noted from historic spill impact experiences along Texas beaches in recent years (*Ixtoc*, -*Alveus*), the interaction of a large spill can lead to temporary beach closures, sand removal, displacement of recreational activity, and economic consequences which will directly affect the businesses and support services directly associated with the beaches impacted, and it can indirectly spread throughout the community if the spill effects and publicity persist. Sorensen (1990) reviewed the socioeconomic effects of several historic oil spills on beaches and concluded a major spill impacting a coastal recreation area would reduce visitation in the community of impact by 5-15 percent over one season, but visitor use would return to normal at the affected park and recreation areas by the next season. Impacts to recreation and tourism at the state or regional level were not evident from Sorensen's investigations of historic major oil spills. Small spills that come ashore on recreational beaches will remove the impacted area from public use for a few days, but is unlikely to cause park and recreation area closures or affect use levels within the park affected.

Accidents and carelessness associated with offshore oil and gas operations contributes trash and litter to the marine environment. All types of packaging, containers and operational waste are impacting Gulf of Mexico beach parks. Merchant shipping operations, commercial fishing, naval operations, recreational fishing, cruise ships and beach users themselves also contribute to the trash and debris which affects the aesthetics of coastal beach park and recreation areas. Texas and Louisiana have been removing a ton or more of trash per mile of beach during annual beach cleanups. Padre Island National Seashore which has inventoried 55-gallon drums washing ashore since 1984 (an average of

200 drums wash ashore along the 65 mile seashore each year) has been most seriously affected by marine debris, but all coastal beach parks are impacted. Historically, the oil and gas industry is believed to be responsible for 10-12 percent of beach trash loads on Texas and Louisiana beaches, but new operational practices and marine education programs are expected to greatly reduce their contributions. New laws, regulations and education and awareness programs are expected to reduce the gravity of this problem Gulf-wide over time, however the persistent nature of modern waste (plastics) in conjunction with increased commercial, industrial and recreational use of the Gulf of Mexico portends continued degradation of coastal beaches from marine debris. Marine debris is not expected to cause park and recreation area closures, but it may lead to a loss of visitation at some parks (Padre Island National Seashore) and contribute to a decline in the quality of recreational experiences by residents and tourist at Gulf of Mexico beaches.

In summary, routine drilling and production in nearshore tracts within 10 miles of coastal park and recreation areas off the coasts of Louisiana, Mississippi and Alabama will be visible from shore in fair weather conditions and could spoil the natural recreational setting of the beach vista for residents and tourists opposed to offshore oil and gas leasing. Fishermen however will find the more accessible offshore gas and oil structures to be excellent locations for recreational fishing and diving. Accidents, carelessness and illegal dumping associated with commercial, industrial and recreational use of the Gulf of Mexico will exacerbate beach trash and litter problems affecting the use and enjoyment of coastal park and recreation areas. Two pipeline landfalls and many small oil spills will temporarily (less than three weeks) remove portions of coastal beaches from recreational use, but will not affect the level of park use. Large oil and petroleum product spills over the next 45 years will cause temporary closure (up to six weeks) of park and recreation areas in Texas, Louisiana and Mississippi and effect a tourism loss at the community level of up to 15 percent during the year of impact.

CONCLUSION: Under the cumulative scenario it is expected that a major recreational beach from Texas to Mississippi would be closed approximately once every three years for up to six weeks during cleanup operations associated with major oil pollution events. Although losses could reach 15 percent of expected visits at the effected recreation area and associated businesses during the year of impact, recreation and tourism levels at the state or regional levels should be unaffected. The ambience of coastal recreation areas from Texas to Florida will be affected by the sight, sounds and residuals (trash, debris, tar balls, drilling rigs) of continued commercial, recreational, and industrial development and use of the Gulf of Mexico and associated coastal areas. These chronic intrusions into coastal park and recreation areas may affect the quality of recreational enjoyment, but are unlikely to lead to park closures or detectable losses in recreation visits. The incremental contribution of the proposed action is expected to add to the number of pollution events likely to occur in the Gulf's coastal and marine environments over the life of the proposed program. Less than two percent of the chronic pollution in the Gulf over the life of the proposal is likely to associated with the proposed action.

(b) Pacific Region

The principal sources of cumulative impacts to recreation and tourism resources in the Pacific OCS Region are the state of the economy (both at the local and national level), continued population growth and development of the west coast (particularly southern California), access to recreational sites, overcrowding at recreational sites, and major harbor projects. These factors overshadow all other impacting agents including those associated with oil and gas operations.

Although it is somewhat difficult to quantify, the general economic health of a community will influence the ability of individuals to devote their financial resources to recreational pursuits. As an example of how economic factors can have a negative impact, the number of tourists visiting southern California decreased when gasoline prices increased dramatically in the mid-1970's. The additional cost of gasoline altered the plans of many tourists originally expected to visit southern California.

Another factor affecting recreational resources is the continued population increase and development of the southern California coast. More people are using recreational facilities than ever before simply because there are more people. Some sites, particularly public beaches, are so crowded on holidays that the enjoyment experienced by some users is substantially decreased from their previous experiences.

A major harbor project, targeted for the year 2020, has been proposed for the Los Angeles/Long Beach harbor area. This project calls for the improvement of existing harbor facilities and the construction of new port facilities. The project could cause a reduction in recreational boating activities and a decline in the visual quality of the coastline in the vicinity of construction activities. These impacts will continue for the duration of the construction phase of the project, but once construction is completed, visual quality will return to pre-project levels. Completion of the harbor project may result in additional conflicts between commercial vessels and recreational boating. One purpose of the project is to increase the commercial traffic capabilities of the harbor. With more commercial traffic using the port, the probabilities for conflicts between recreational boaters and commercial vessels will increase. These conflicts will continue for the life of the harbor project, but are not expected to have measurable effects on the level of recreational boating activities in the Southern California Planning Area.

Oil and gas activities that can affect recreational resources include routine drilling operations, platform placement and operations, pipeline installation, and accidental spills.

There are 23 platforms in place in the Pacific OCS Region at present, including three platforms awaiting start up and two platform jackets. Ten additional platforms are projected to be installed on existing leases over the life of the proposed program. Seven platforms are hypothesized to be installed as a result of this proposal. A total of 21 platforms are expected to be removed from the OCS over the 35 year life of the proposal.

A total of 8 platforms and 6 artificial islands are in place in State waters, and are producing hydrocarbons. No additional offshore oil and gas facilities are anticipated in State waters. Normal operations of all these facilities, including platform installation and removal, are not expected to affect access to onshore recreational resources in the planning area, or affect the number of tourist visits to southern California. Given the amount of time required to plan and implement exploration and development operations, the complexities of the permitting process, and the number of platforms expected to be removed over the life of the proposal, the number of platforms in place at any one time offshore southern California is expected to remain relatively constant at the present level throughout the 35-year life of the proposed action.

With the addition of up to 17 new platforms (10 projected and 7 hypothesized) and removal of as many as 21 existing offshore facilities in the Southern California Planning Area, the viewshed along the coastline will change due to the redistribution of visible platforms. The installation and removal of platforms is expected to occur sporadically over the entire 35 year life of the proposal. As stated in the base case, it is likely that some of the platforms may be installed in areas out of sight from the coast. However, it is possible that one or more platforms will be located as close as 4.8 kilometers (3 miles) from shore, while others may be located within 10 kilometers (6.2 miles) from shore. The average distance from shore for OCS platforms in the Pacific OCS Region is 10.1 kilometers (6.3 miles). Platforms located within these distances could result in a noticeable change in scenic quality.

Platform installation and operations affect recreational resources by inserting a man-made structure into a 0.8 km^2 (0.3 mi^2) area which had previously been open water suitable for boating or sailing. The area displaced by all existing and projected platforms could total 38.4 km^2 (14.8 mi^2), an extremely small area in relation to the total area of the planning area. The area displaced by oil and gas platforms will be unavailable to boaters, however, installation and routine operation of platforms on the OCS have not had measurable adverse effects on recreational boating. For the most part, pleasure boats in the proposed project area stay within sight of the shoreline. Major exceptions are vessels in transit across the Santa Barbara Channel to the Channel Islands. In those instances, platforms serve as navigational aids and occasionally as centers of emergency assistance. Noticeable changes to water-dependent recreational activities are not expected.

Oil and gas platforms offer habitat to a number of recreationally important fish species. Much of the sea floor in the Southern California OCS Planning area is a featureless combination of mud and sand. An oil and gas platform provides a solid structure where invertebrate organisms and fish concentrate. Recreational fishermen are aware of this relationship and will actively pursue fish in the vicinity of existing, projected, and hypothesized OCS facilities. Overall, recreational fish harvest and level of fishing effort at the platforms will not change measurably over the current levels because the number of platforms in the Region is expected to remain relatively constant over the life of the proposal. The platforms will continue to serve as recreational fishing sites for as long as they remain in place, even if they are not actively producing hydrocarbons.

At some point during the 35-year proposal life, it is also assumed that a pipeline proposed in a currently approved oil and gas development plan will be constructed to a shoreline landfall in the northern Santa Maria Basin. Potential impacts associated with offshore pipeline construction include disruption of recreation use of beach in the vicinity of the landfall, prohibited recreational use of waters within 1,000 meters of the pipeline lay-barge, and increased vessel traffic between the lay-barge and servicing harbor. These impacts will be limited to the immediate vicinity of the pipeline project and are expected to last for the duration of the installation process, approximately three months. No measurable effects to recreational and tourism resources in the Southern California are expected as a consequence of the pipeline installation. No additional pipeline landfalls or new onshore facilities are hypothesized as a consequence of the existing oil and gas activities or the proposed action.

In the cumulative case, a total of 17 oil spills greater than 1,000 bbl have been hypothesized to occur in the Pacific OCS Region over the 35-year life of the proposal. One pipeline spill (estimated at 7,000 bbl) and one platform spill (estimated at 20,000 bbl) are hypothesized to occur in southern California. Five tanker spills (30,000 bbl each) of Alaska OCS production are estimated to occur along the west coast of the United States. Five TAPS tanker spills and five import tanker spills are also projected to occur along the U.S. west coast between the Canadian and Mexican borders. Tanker spills hypothesized offshore Washington, central California, and southern California are assumed to occur within 80 km (50 miles) of the coastline and contact the shore. Tanker spills offshore Oregon and northern California are assumed to occur more than 80 km at sea and are not expected to contact the coast. For purposes of analysis it is further assumed that the spills will occur with uniform frequency and spatial distribution within each Pacific OCS planning area over the life of the cumulative scenario. No additive effects from multiple spills are expected.

A spill contacting the shoreline will impact recreational use of the affected area. Beach use, viewshed, and water oriented activities in the vicinity of the spill will be disrupted for the duration of clean up operations, approximately one month. Recreationists will relocate to other sites not affected by the spill, causing economic losses to merchants who service the affected beach. Although, in reality, a potentially large number of people will visit the oil spill site to observe the spill and associated cleanup activities. Cleanup personnel, regulatory agency personnel, and media representatives would add to the temporary influx. Although this will not offset the economic loss experienced by the reduction in recreational activities, they will contribute to the local economy.

Should the spill occur during the peak beach-use season (June-September) and result in closure of a popular beach for a period of a month or more, economic losses to local merchants will be substantial, possibly as much as 20 percent of their annual income. In addition, recreation use levels at the affected beach may not return to pre-spill levels for one to two seasons following the spill as a result of the public's memory of the spill and reluctance to return to the affected area. Consequently, local merchants could sustain reduced incomes until recreation use returns to pre-spill levels.

Tourists, beach users, and ocean water sports participants will relocate their recreational activities to non-affected sites for the duration of the spill and clean up operations. Some are likely to delay returning to the affected site for one to two seasons after clean up activities are completed. This could result in overcrowding at some sites, and a degradation of individual recreational experiences.

CONCLUSION: Public use of recreational resources and recreation-based expenditures are expected to continue to increase in the Pacific Region. The primary impact agents affecting recreational resources are the state of the economy and the ability of people to devote a portion of their financial resources to recreational interests. Accidental oil spills from the transportation of OCS and non-OCS oil could have serious, temporary effects on recreational resources. These effects include closure of affected beaches and disruption of water oriented recreational activities in the nearby vicinity for a period of approximately one month during clean up operations. In addition, merchants serving affected beaches will sustain an economic loss of up to 20 percent of their annual income if a popular beach is closed for a month during peak use period. Use of recreation resources will return to pre-spill levels in approximately 2 seasons.

(c) Atlantic Region

The combination of historic sites, long stretches of oceanfront shoreline and numerous barrier islands, and wetland environments make the Atlantic coast from Maine to Florida a popular vacation spot. As the area's population grows in the future, the role of the coastal recreation and tourism industry, as a job provider, is expected to increase. This will increase the dependence of area economies on this industry, resulting in greater promotional efforts and sustained growth. The existing conditions for the coastal recreation and tourism industry in the Atlantic States are described in Section III.D.3.d.

Although the coastal recreation and tourism industry is already well developed along the Atlantic coast, many areas continue to be developed further. As the industry grows so does its importance as a provider of employment opportunity and tax revenue. This gives State governments a compelling reason to promote this industry. Promotional efforts include beach replenishment programs, public beach access laws and programs, and capital improvement at public recreation sites intended to enhance the visitor's experience and increase the number of tourists. As the potential for profit grows, private operators will continue to develop vacation resorts, build vacation homes, and open tourist-oriented retail businesses. And as the resident population increases, the need for a diversified economy will continue to increase the importance of coastal recreation and tourism industry to the region's economic health.

Potential impacts to coastal recreation and tourism under the cumulative-case scenario are expected to increase over the impacts under the base case. This is because the cumulative-case scenario assumes the drilling of a total of 210 wells and the installation of 9 production platforms, 4 gas pipelines, and 4 gas processing plants.

With the drilling of an additional 67 wells and the construction 3 more production platforms assumed in the cumulative case, the offshore acreage affected by spatial exclusion zones surrounding drilling operations will increase. However, as discussed in the base case (see Section IV.D.1.a(14)), the exclusion zones are expected to have little impact on recreational fisheries because fish targeted by the sport fishing industry move in and out of the area. The increase in drilling activity also increases the prospect of the coastal visitor being able to see the beacon at the top of a drilling rig located on offshore leases . However, this sighting will only occur under ideal climatological conditions from barrier islands in Dare County, NC. Additionally, the acreage of potential leases close enough to land for offshore operations to be visible will not change. Therefore, spatial and visual impacts under the cumulative-case scenario are not expected to change from those assumed for the proposed action (see Section IV.D.1.a(14)).

In the cumulative-case scenario, 13 oil spills greater than or equal to 1,000 bbl are assumed to occur from the tankering of non-OCS oil. For routine activities associated with offshore development and an accidental oil spill, the potential impacts to the coastal visitor are visual degradation of the coastal environment and reduced access to public recreation areas. This may result in coastal visitors avoiding the areas of oil spill contact causing economic losses to the coastal recreation and tourism industry.

The additional gas pipeline and gas processing facility assumed for the cumulative case are expected to increase the onshore area that is expected to be made unavailable for public recreation. However, Federal and State regulations ensure that any onshore development consider the health of the physical and socioeconomic environment before siting decisions are approved. Therefore, it is expected that Federal and State reviews will result in the location of landfall for the additional pipeline and the site of the gas processing plant being directed away from sites that are important to the coastal recreation and tourism industry. In this case, the impact on the coastal recreation and tourism industry under the cumulative-case scenario is expected to remain the same as for the base case.

In summary, the potential for visual impact to the coastal visitor from drilling operations on approximately 10 percent of potential leases is limited to two coastal counties. Few impacts on recreational fishing activities due to the presence of offshore drilling and production structures and their spatial exclusion zones are expected. Establishing support bases at commercial ports is not expected to prevent use of existing coastal recreation sites or remove areas for consideration for future recreational development. Maintenance of the additional gas pipeline under the cumulative-case scenario is expected to prevent future recreational and commercial development on that site. It is assumed that the additional gas processing facility will be built in an area of existing urban/industrial development. Therefore, access to public recreational sites is not expected to change from the base case. A oil spill greater than or equal to 1,000 bbl that contacted recreational sites preventing use or access to the area is expected to have serious impacts on the affected area's coastal recreation and tourism industry. The impact to the industry is expected to last for at least the first tourist season after the spill. The type of recreational activity affected by spilled oil determines the seriousness of the economic impact. Other factors to consider are timing of the spill, location of contact, amount of publicity, and success of cleanup efforts.

Important growth in the revenue-generating capacity and infrastructure of the coastal recreation and tourism industry is expected from projected increases in coastal resident population.

CONCLUSION: Offshore operations assumed under the cumulative scenario for the proposed action are expected to create a visual impact on the coastal visitor to barrier islands in Dare County, NC. A permanent visual impact is also expected along some sections of the maintenance ROW for the assumed gas pipelines. Impact on public access to coastal recreation sites are expected to be limited to the gas pipeline construction period. Growth in the economy unrelated to OCS activities is expected to have a beneficial impact on the coastal recreation and tourism industry.

2. Alternative II — No Action

The no action alternative assumes that the Proposed Comprehensive OCS Natural Gas and Oil Program (1992-1997) would not be adopted and that natural gas and oil resulting from this program would not be available. The natural gas and oil resources assumed to be produced by the proposed action (Alternative I) that would be forgone by the no action alternative are indicated in Table IV.D.1.a-1.

Under Alternative II, all environmental impacts associated with the proposed action, as described in Section IV.D, would not occur. The incremental contribution of the proposed action to cumulative effects would also be forgone; however, such effects from other activities would remain. Cancellation of the proposed program would result in alternative energy substitution.

The following discussion presents an analysis of the likely alternative energy sources and accompanying impacts for the proposed program substitution. This is followed by an analysis of the environmental impacts associated with the no action alternative.

a. Alternative Energy

The term energy "alternative" as used in this discussion does not imply that any one alternative (e.g., increased domestic production or conservation) solely and totally can or would replace the natural gas and oil generated by the proposed program. Rather, the alternative is really a measure, in conjunction with other measures, that acts to replace in part the energy precluded by the no action alternative.

Appendix C ("Comparative Environmental Analysis of Energy Alternatives of OCS Oil and Gas") presents an assessment of the environmental impacts associated with energy alternatives to OCS natural gas and oil (ICF Resources, Inc., 1991). This assessment focuses on the most likely mix of market-driven replacements for energy that could be produced from the proposed program. It also considers the impacts of potential Government-imposed measures. The Appendix C assessment focuses on environmental impacts aspects and is drawn from a broader and more detailed analysis prepared by ICF Resources, Inc. (1991) which provides economic analyses of the alternatives and environmental impacts for the complete fuel cycle of each alternative.

The possible energy alternatives to OCS oil and natural gas considered in Appendix C included the categories of: oil and gas supply substitutes (e.g., domestic enhanced oil recovery or coalbed methane); fuel substitutes (e.g., nuclear-electric or photovoltaic); and conservation (e.g., improved building shells or appliance efficiency). These possible alternatives were then narrowed down for in-depth economic and environmental analyses based on preliminary economic screening, inclusion in the National Energy Strategy (NES) baseline, or request for consideration by MMS. The resultant list included both market-driven and Government-imposed alternatives (Appendix C, Table III-2). The energy alternatives considered in this list included the categories of supply substitution (oil and gas); fuel substitution in transportation (oil) and in electricity generation (gas); renewable resources of electricity generation (gas); and conservation measures (oil and gas). The environmental impacts associated with each of these alternatives are presented in Chapter IV of Appendix C.

Most Likely Mix of Replacements for Proposed Comprehensive Program: Under the no action scenario, the energy alternative substitution and related environmental effects are expected to be those due to market forces. The most likely mix of market-driven replacements for the proposed program is shown in Table IV.D.2-1 (from Appendix C, Chapter III). This table shows that the primary substitute for reduced OCS oil would be an increase in imported oil (86%), whereas the primary response to reduced OCS natural gas would be both increased domestic onshore gas production (44%) and switching to oil (residual fuel) (34%), primarily in utility boilers.

ICF Resources, Inc. (Appendix C) examined the environmental impacts of each of the components (energy alternatives) comprising the most likely mix replacing the OCS natural gas and oil from the proposed program. Impacts were considered under four categories and 15 subcategories: **Air** – ambient pollution, stratospheric ozone, acid rain, global warming, and noise; **Water** – surface water

Table IV.D.2-1 Market Changes Associated with Loss of One Unit of OCS Oil and Gas

Market Activity	Change	Market Activity	Change
Lost OCS Oil	(1.00)	Lost OCS Gas	(1.00)
Increased Oil Imports	0.86	Increased Gas Imports	0.08
Increased Domestic Onshore Oil Production	0.04	Increased Domestic Onshore Gas Production	0.44
Oil Conservation*	0.06	Gas Conservation*	0.14
Switch to Gas	0.04	Switch to Oil	0.34

*Plus possible minor switching to energy sources other than oil or gas

pollution, groundwater contamination, and ocean pollution; **Land** – solid wastes, loss of wetlands, wildlife, soil erosion/vegetation loss; and **Societal** – scenic pollution, health and safety, and changes in land uses. The major conclusions on environmental impacts for each energy alternative are presented below. Details are provided in Appendix C.

(1) Impacts Associated with Replacements for Proposed Comprehensive Program OCS Oil

INCREASED OIL IMPORTS: The majority (86%) of the OCS oil assumed to be produced from the proposed program would be replaced by oil imports.

The major environmental impacts associated with the expanded importation of oil include: the generation of greenhouse gases and regulated air pollutants from both transport and dockside activities, emissions of NO_x, SO_x, and VOCs having an impact on acid rain, tropospheric and stratospheric ozone formation; degradation of water quality in the instances of oil spills from either accidental or intentional discharges or tanker casualties; possible destruction of flora and fauna and recreational and scenic land and water areas in the instance of oil spills; and the public fear of the increased likelihood of oil spills.

INCREASED DOMESTIC ONSHORE OIL PRODUCTION: The other oil supply substitute (besides oil imports) is the increase in U.S. onshore oil production — this representing only 4 percent replacement for the oil assumed to be produced from the proposed program.

The greatest potential for significantly increasing the domestic crude oil supply lies with the successful application of enhanced oil recovery (EOR) processes to known reservoirs and by additional drilling in existing fields (infill drilling). The EOR processes which would be used fall into the categories of chemical flooding, miscible flooding, and thermal recovery methods. A key feature common to all three methods is the need to inject liquids or gases to mobilize and displace otherwise unrecoverable oil. The EOR activities do not usually impose significant additional negative impacts in areas where primary and secondary recovery have already occurred.

The major environmental impacts associated with expanded domestic onshore oil production using EOR techniques include: potential degradation of local ambient air quality from atmospheric emissions of dust, engine exhaust, off-well gases, gas flaring products, particulates, SO_2, CO, NO_x, H_2S, and hydrocarbons and the consequent formations of acid rain, tropospheric ozone, and depletion of stratospheric ozone; potential degradation of local and national air quality due to emissions of greenhouse gases, especially CO_2 used in miscible flooding; possible degradation of both surface water and groundwater quality from spills or leaks of process chemicals during handling, mixing, or injection; increased potential for chemical contamination of drinking water by injected fluids left in the reservoir; expanded land use through more intensive field development, (i.e., more wells, roads, injection lines, and facilities); and health risks to workers from the handling of the toxic chemicals used in thermal and chemical recovery processes.

OIL CONSERVATION: Ten percent of the oil assumed to be produced from the proposed program would be offset by a decline in oil consumption in the form of conservation and fuel switching. Oil conservation represents 6 percent of the total replacement for the proposed program OCS oil. The remaining 4 percent would be offset by switching from oil to natural gas (discussed below).

Oil conservation would likely be expressed in the transportation and industrial sectors. Under transportation this conservation may be in the form of increasing fuel economy (e.g., more fuel efficient vehicles, driving smaller and lighter cars, driving at slower speeds, and replacing gasoline engines with diesel engines) or by reducing miles travelled by private vehicles by using public transit.

All these transportation-related measures are believed to have positive net impacts on the environment in that they mean a reduced need for oil. More efficient vehicles use less energy. A decrease in gasoline being delivered to the service station translates into a reduced demand by the transportation sector for barrels of oil. The barrels of oil forgone would have zero net impact for production and transportation. Water and land impacts, in addition to solid waste would be zero. Thus, the impacts on the environment from oil conservation, through these alternatives, tend to be highly positive from a supply standpoint, though the alternatives do have some negative impacts if end-use were also to be considered.

A major industrial end-use category for petrochemicals is plastics. Because petroleum hydrocarbons are a major feedstock for plastics, the reduced consumption of plastics is an energy alternative to oil (or natural gas liquids) production. By substituting other end products for plastic products, the impacts associated with plastic production will be decreased. However, there will be other impacts associated with the substitutes' production and uses. For example, substituting some plastic parts in automobiles with steel would lead to greater energy consumption and possibly greater attendant environmental impacts (steel production requires coal production; steel adds weight to a vehicle thus making it less fuel efficient and raising gasoline use which requires increased oil production or import). Thus, a clear advantage from the standpoint of reduced environmental impacts is not obvious by reducing plastic feedstock consumption.

SWITCH FROM OIL TO GAS: The likely area for the 4 percent oil-to-gas switching is as a fuel (feedstock) for the generation of electricity. The oil that would be replaced in this case would be residual fuel oil — a heavy petroleum product. The additional gas needed to replace the residual fuel oil would likely come from increased domestic onshore gas production resulting from tight sands gas and coalbed methane.

Environmental impacts associated with increased domestic onshore gas production are discussed later in this section under "Impacts Associated with Replacements for Proposed Comprehensive Program OCS Natural Gas." Basically, this switch from oil to natural gas includes impacts related to emission of regulated air pollutants and greenhouse gases; effects of produced waters; potential contamination or disruption of aquifers; effects on ecosystems, soil and wildlife by land preparatory activities; and risk to workers handling toxic chemicals added to fracturing fluids.

(2) Impacts Associated with Replacements for Proposed Comprehensive Program OCS Natural Gas

INCREASED DOMESTIC ONSHORE GAS PRODUCTION: The largest component, replacing 44 percent of the OCS natural gas assumed to be produced from the proposed program, would come from U.S. onshore production of gas. This direct supply substitute is associated with the development of gas reserves from tight sands and coalbed methane.

In the development of tight sands gas, the low permeability formation is fractured, and the hydraulically-induced fractures are kept open by introduction of substances like sand, glass beads, or bauxite. Coalbed methane or natural gas production generally involves hydraulic fracturing of the coal seam by removing water with subsequent release of the methane or natural gas from the seam. Both coalbed methane and tight sands gas recovery procedures produce essentially the same environmental impacts as conventional onshore natural gas production.

The environmental impacts associated with producing the unconventional reserves of natural gas from tight sands and coalbed formations include emissions of noise and regulated pollutants from diesel and gas-fueled support equipment, compressor engines, and fugitive leaks from accessory equipment. Emissions of SO_x, NO_x, and VOC could potentially impact acid rain and tropospheric ozone formation. Additionally, the emissions of NO_X could have negative impacts on stratospheric ozone. There will also be emissions of greenhouse gases, especially methane and CO_2, but these quantities will be less than those generated from conventional production activities. The primary wastes of onshore gas production are "produced water" that exists naturally in oil and gas formations and drilling fluids. The major environmental water quality concern with tight sands gas and coalbed methane recovery using hydraulic fracturing are the potential contamination or disruption of aquifers in the case of permanent injection of toxic fracturing fluids in the aquifers. Conventional land preparatory activities adversely affect ecosystems, soil, wildlife, and possibly wetlands depending on where the wells are located. The major societal impacts are risks to workers from handling the toxic chemicals added to the fracturing fluid.

SWITCH FROM GAS TO OIL: It is estimated that 34 percent of the OCS natural gas assumed to be produced from the proposed program would be replaced by oil on a BTU basis [BTU = British thermal units, where 1.031 thousand cubic feet of natural gas = 6.287 barrels of oil (residual fuel)]. Most of this oil would be residual fuel oil (heavy petroleum product remaining after the more valuable products, like gasoline, have been distilled from the crude oil). The additional residual fuel oil would be imported.

The importation of residual fuel oil into the U. S. would be similar to importing crude oil and would involve similar impacts. Environmental impacts associated with oil imports have been discussed earlier in this section under "Impacts Associated with Replacements for Proposed Program OCS Oil." These impacts include such items as those related to generation of regulated pollutants and greenhouse gases, degradation of water quality and affect on organisms, and public fear of the increased likelihood of oil spills.

GAS CONSERVATION: Fourteen percent of the OCS natural gas assumed to be produced from the proposed program would be offset by gas conservation, in particular, by improvement in the efficiency of residential gas appliances. Forgone gas consumption would not produce air, water, or land impacts or generate any solid waste and, thus, would have zero environmental impact.

INCREASED GAS IMPORTS: Gas imports, as liquified natural gas (LNG), would be the other direct supply substitute (besides increased domestic onshore gas production), replacing 8 percent of the OCS natural gas assumed to be produced from the proposed program.

The only major environmental impacts associated with expanded LNG importation would be in the case of LNG carrying tank punctures or leaks during unloading. Because LNG readily vaporizes, but does not disperse quickly and remains near ground level, accidental ignition of the vapor clouds would have tremendous explosive power. Regulated pollutant emissions during transport and unloading are not a significant problem due to the ships' special combustion system, the use of natural gas, and the special unloading process.

(3) Overview/Comparison of Impacts Associated with OCS Oil and Gas and Most Likely Mix of Alternatives

A summary of major impacts for the energy alternatives considered and a comparison with OCS oil and gas illustrative cases are presented in Appendix C (Tables IV-19 and IV-20). This summary presents a comparative overview of the energy alternatives in terms of categories of impacts (e.g., "regulated pollutants" for air impacts, or "groundwater" for water impacts) considered, but does not indicate the level (severity) of the impact because this is very much related to site-specific and scenario-specific conditions. A brief discussion of the major differences in the types of impacts among the most likely mix of alternatives to the OCS proposed program and the development (production and transportation) of the OCS oil and gas follows.

With reference to energy alternatives to OCS crude oil (Appendix C, Table IV-19), the major impacts of the oil alternatives are, for the most part, in the same categories as the OCS oil case. Only oil conservation is very distinctly different. The amount of oil forgone by this decline in oil consumption alternative results in essentially zero impact. (As discussed earlier, this is correct for transportation-related conservation measures; in the case of oil use for plastics, this is less clear). OCS oil development is characteristic in that no major impacts are associated with most land impacts categories ("erosion/vegetation" and "wildlife"). Conversely, no major "ocean" water impact (as may result from oil spills) is associated with increased domestic onshore oil production.

With reference to energy alternatives to OCS natural gas (Appendix C, Table IV-20), the gas conservation alternative is clearly different. The gas consumption forgone by this alternative would have essentially zero environmental impact. Most of the renewable energy alternatives (wind, solar thermal, and photovoltaic) are notable in terms of their lack of air impacts. Impacts on water, land, and society are more complicated, although here again renewable alternatives appear to be more beneficial. The increased domestic onshore gas production is characteristic in that it does not result in major "ocean" water quality impacts as contrasted to OCS gas development (involving drill muds and produced waters) or the switch to residual fuel oil alternative (involving tankering and possible oil spills). Conversely, increased domestic onshore gas production results in major land impacts, whereas OCS gas development and the switch to residual fuel oil alternative does not (unless construction of a new port is needed).

b. Environmental Impacts of the No Action Alternative

By the no action alternative, all the potential impacts to vulnerable physical, biological, and socioeconomic resources from the proposed action, as described in Section IV.D, would be precluded or "lost." Additionally, the incremental contribution of the proposed action to the cumulative impact (Section IV.D.1.c) would also be eliminated.

The impacts resulting from or "gained" by the no action alternative would be those associated with the alternative energy substitution for the OCS proposed program. The most likely mix of the energy alternatives and their accompanying impacts were described in the preceding section. Of this mix of alternatives, the major components identified are imported oil, increased domestic onshore natural gas production, and conservation (Table IV.D.2-1). Imported oil is the largest single component representing 86 percent of the replacement for OCS produced oil and 34 percent of the replacement (imported residual fuel oil under "Switch to Oil") for OCS natural gas. Increased domestic onshore gas production (mostly from tight sands and coalbed methane production) represents 44 percent of the replacement for OCS produced natural gas. Conservation substitutes 6 percent for OCS oil and 14 percent for OCS gas. The other components, including switch to gas (4% replacement) and increased gas imports via LNG (8% replacement), are comparatively minor contributors to the overall mix.

The following overall no action impact analysis focuses on oil importation because this is the predominant component in the replacement mix, is traditionally of considerable concern because of oil spills, and is the component for which the most precise information is available. A treatment of the other "major" component of the mix, increased domestic onshore gas production, is also provided. Conservation, as indicated earlier, results in essentially no impacts.

(1) Impacts Due to Increased Oil Imports

The oil and natural gas resource estimates for the proposed action are shown in Table IV.D.1.a-1. Under the no action circumstance, most of this crude oil (86%) and much of the natural gas (34%) will be replaced by importation of foreign oil by tankers (Table IV.D.2-1). The 34-percent replacement for OCS natural gas involves a "switch to oil" (residual fuel oil), whereby 6.3 trillion cubic feet of gas equals approximately 1 billion barrels of oil.

The imported oil replacing the OCS oil and gas will enter the United States primarily in the Gulf of Mexico, some in the Pacific (California), and a small amount in the Atlantic Region. None of this imported oil will go to Alaska. It will take approximately 7,000 tanker trips (tanker capacity of 600,000 bbl or 100,0000 dwt) to import this oil. Based on the rate of spillage of imported oil from tankers (Section IV.D.1.a), this oil import scenario translates into seven spills equal to or greater than 1,000 bbl occurring in the Gulf of Mexico Region and one in the Pacific Region off California. Because of the lack of imports into Alaska and the small volume into the Atlantic Region, no large oil spills are assumed or impacts analyzed for these two Regions.

For the Gulf of Mexico Region, it is assumed that seven import tanker oil spills (30,000 bbl in size) would occur under the no action alternative. Of the seven import spills estimated to occur Gulf-wide, it is assumed that two such spills will contact the Texas coastline (Houston/Galveston area) and two spills will contact the Louisiana coastline (Mississippi River Ports/LOOP facility). It is assumed that one of the spills contacting the Texas coast and one contacting the Louisiana coast will each affect 50 km of recreational beaches.

For the Pacific Region, it is assumed that one import tanker oil spill (30,000 bbl) would occur under the no action alternative. It is assumed that the spill will occur within 80 km of the coast and contact the shoreline in the Southern California Planning Area.

The impacts associated with the assumed large spills from foreign imports are as follows.

(a) Impacts on Water Quality

1) Gulf of Mexico Region

The four assumed spills (30,000 bbl) will introduce oil into nearshore waters, creating elevated hydrocarbon levels (up to 100+ug/l) within affected waters. Much of the oil will be dispersed throughout the water column over several days to weeks. In shallow areas, oil may become entrained in suspended particles and bottom sediments. Water uses would be affected up to several weeks from these spills and then only near the source of the slick. Booming would serve to preclude impacts in most estuarine waters there.

CONCLUSION: An identifiable change to the ambient concentration of one or more water quality parameters will be evident in and around oil slicks for a period lasting up to several weeks in duration in marine and coastal waters. In poorly flushed coastal waterbodies, localized increases in trace metal and hydrocarbon concentrations may be severe and persist for months or longer.

2) Pacific Region

Oil from the one assumed spill is expected to elevate hydrocarbon levels up to 100+ug/l within the affected waters over a period of several days to weeks. Effects to offshore water use are expected to be limited to an area of 1,000 km^2 or more for the duration of the spill.

CONCLUSION: Temporary effects on water quality are expected over an area of a thousand square kilometers or more for a period of several weeks.

(b) Impacts on Air Quality

1) Gulf of Mexico Region

For spills greater than or equal to 1,000 bbl, emissions are of the order of 285 tons/hour or smaller. Concentrations reaching onshore areas from these spills would be on the same level as indicated by the base case based on the dispersion, limited input of pollutants to the atmosphere, and transport regime present. Emissions from these oil spills will last until all the volatile compounds are evaporated, which takes about three days.

CONCLUSION: Because of the Gulf's atmospheric regime and the anticipated emissions from import spills, the air quality status in the Gulf of Mexico will not change because of the emissions from this alternative.

2) Pacific Region

Depending on the composition of the crude oil, information taken from Form and Substance Inc. (1983) indicates that total hydrocarbon emissions during the first hour would be approximately 57 lbs/bbl, decreasing to 29 lbs/bbl in the second hour. Assuming the spill hypothesized for the Southern California Planning Area occurs within one hour, total emissions during the first and second hour would be 1,710,000 lbs and 870,000 lbs, respectively. In the event the spill occurs near shore, impacts could result in short term exceedance of the onshore air quality standards in the vicinity of the spill. However, onshore effects are highly dependent on the distance offshore, and weather conditions and time. Spills greater than 3 miles from shore are unlikely to have a long term, measurable effects on onshore air quality.

CONCLUSION: It is expected that as a result of the accidental oil spill, local air quality standards in the vicinity of the spill will be temporarily exceeded. These exceedances are expected to last for the duration of the spill, but are not expected to result in long term effects to onshore air quality.

(c) Impacts on Marine Mammals

1) Gulf of Mexico Region

For both the threatened and endangered cetaceans as well as the nonthreatened and nonendangered cetaceans the effect from oil spills is expected to be primarily sublethal and lasting less than one generation with fewer than five deaths. A generation is defined as the term of years accepted a the average period between the birth of the parents and the birth of their offspring. All individual deaths due to spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: For both the threatened and endangered cetaceans as well as the nonthreatened and nonendangered cetaceans there will be no discernable decline in population, and no change in distribution or abundance.

2) Pacific Region

THREATENED AND ENDANGERED SPECIES: As was described in the base case analysis, it is expected that the 30,000 bbl oil spill assumed to occur in the Southern California Planning Area will result in no mortality of gray or other endangered whales and will not disrupt the species migration through the area.

The very low densities of Guadalupe fur seals estimated to occur in southern California waters make it unlikely that more than a few individuals would be contacted and killed by an accidental oil spill. Such a low level of deaths is expected to be indistinguishable from natural variation in the fur seal population and is not expected to impede the specie's recovery.

The small California steller sea lion population at the southern limit of this specific range is not expected to require more than two generations (12 years) for recovery from oil spill effects.

Assuming that a spill were to come ashore within the California sea otter range and contact otters, this then could result in the death of up to 250 sea otter population, the loss of a portion of the otter habitat for a period of several months or more, and a population recovery period of 4 to 5 years. If the spill occurred south of the northern Channel Island chain and contacted the south side of San Nicolas Island, the small colony of translocated sea otters (less than 20 animals) would probably be eliminated as a viable population.

CONCLUSION: It is expected that there would be no measurable effect on the Guadalupe fur seal population and no mortality of gray or other endangered whales nor change in these species distribution or abundance. Steller sea lion are expected to require up to 12 years for recovery from oil spill affects. The death of up to 250 California sea otters these and the loss of a portion of the habitat for a period of several months or more are expected. Otter population recovery will take at least 3 years.

NONENDANGERED SPECIES: The oil spill could conceivably contact a portion of the Southern California Bight minke whale population. It is unknown whether these whales would be temporarily displaced from the area of the spill, but, considering the relatively low density of minke whales in the area, no mortality is expected.

Considering the low population density of killer whales in the southern California area and their great mobility, it is expected that the one large oil spill will cause no mortality and no changes in numbers and distribution distinguishable from natural variability in the population.

It is possible that a few harbor porpoises might be affected, or even killed by an oil spill in the southern California area. However, any mortality caused by spills in this area is expected to be indistinguishable from natural levels of variability in the harbor porpoise population, and any disturbance or displacement of the animals due to a spill or to the ensuing cleanup efforts is likely to last no more than a few months.

No elephant seal mortality due to accidental oil spills is expected.

Assuming that the spill were to contact the rookery beaches on San Miguel Island during the specie's summer breeding season, when thousands of newborn pups are present, it is likely that tens, and possibly hundreds, of California sea lion pups would die. This is less than five percent of the approximately 21,000 California sea lion pups estimated to have been born on the Channel Islands in 1986 (Boveng, 1988b). Given a growth rate of seven percent per year (Boveng, 1988b; Bonnell and Dailey, 1990), recovery of the population from such a loss is expected to take 3 years or less.

Northern fur seals wintering in offshore waters along the west coast are expected to experience little impact with this alternative; loss of individuals breeding on San Miguel Island is expected to require three or more generations (12 years) for recovery. Harbor seal mortality associated with an oil spill in this area is expected to be slight, requiring one generation (4-7 years) or less for recovery.

CONCLUSION: No mortality and no discernable changes in species abundance or distribution of minke whales, killer whales or nonendangered elephant seals are expected. Loss of a few harbor porpoises and temporary changes in the specie's distribution, lasting no more than a few months, is expected. Minor mortality (less than one percent of the annual pup production in southern California) is expected, however, no discernable decline in the elephant seal population and distribution is anticipated. It is expected that there would be mortality of tens to hundreds of California sea lion pups resulting from rookery contact by a summer oil spill. Population recovery will take 3 years or less. Loss of breeding northern fur seals from San Miguel Island is expected to require 12 or more years for recovery. Harbor seal mortality is expected to require one generation (4-7 years) or less for recovery.

(d) Impacts on Terrestrial Mammals

GULF OF MEXICO REGION: It is expected that these oil spills will not contact or affect Alabama, Choctawhatchee, and Perdido Key beach mice or their habitat due to their limited home range.

CONCLUSION: No adverse effects to Alabama, Choctawhatchee, and Perdido beach mice are expected to occur.

(e) Impacts on Marine and Coastal Birds

1) Gulf of Mexico Region

The effect on endangered and threatened birds from oil spills is expected to be primarily sublethal and less than one generation in duration with fewer than five deaths of the brown pelican and piping plover. All deaths of endangered and threatened birds affected will be replaced through natural recruitment from the next generation.

With regard to nonendangered species, it is estimated that these spills (two contacting Texas coastline and two contacting the Louisiana coast) will contact and affect 200 km of beach, 100 km of inshore shoreline, and about 60 ha of wetlands. Lethal effects are expected for no more than 400 birds from direct oiling. Sublethal effects are expected for no more than 4,000 birds from contact with oil and contamination of food sources.

CONCLUSION: There will be no discernable decline in an endangered or threatened bird population or species, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation and any sublethal effects will last less than one generation. There will also be no discernable decline in a nonendangered marine or coastal population or species, and no change in distribution or abundance. Any affected individuals, by death or sublethal effects, will be replaced through natural recruitment from the next generation.

2) Pacific Region

THREATENED AND ENDANGERED SPECIES: Assuming that the tanker spill were to contact the Channel Island breeding colonies of the California brown pelican during spring or summer, perhaps as many as 1,000 adult pelicans could be oiled, with mortality ranging from 20-50 percent of birds contacted. Besides direct mortality, major disruptions in reproduction could be expected, with the potential loss of up to 25 percent of active nests. The overall effect of such a spill on pelican populations would be expected to last for 2-4 years (depending on the food availability during the recovery period). At other times of year or if breeding colonies were contacted, the impact of the 30,000 bbl spill would be much less, with only 100 to 500 birds possibly contacted and recovery within 2 years.

Due to the extreme rarity of bald eagles along the southern California coast, an oil spill is not expected to impact this species. Likewise, a spill is not expected to impact the small resident California peregrine falcon population or the occasional migrants that pass through this area.

Since light-footed clapper rails seasonally breed in about 14 widely-spaced marshes from Santa Barbara to the Mexican border, an oil spill would have to occur and contact the birds at one of these sites. This is considered unlikely, however, as protective equipment (e.g., oil booms) is readily available throughout the rail's range, and oil can generally be prevented from entering estuaries and marshes.

Assuming that the tanker spill were to contacts a least tern colony from May to September, some mortality of adults and some disruption of reproduction is expected. Because of the wide spacing of tern colonies, only one colony should be affected by any single event. Depending on various factors (spill date, spill size, weather, distance from shore), the impact on a colony could range from the loss of a few adults to the loss of an entire colony. Given the size of the tern colonies at risk, no more than 50 pairs or about 5 percent of the population would be affected. However, historically, tern populations have increased only very slowly, and recovery from the loss of more than a few individuals is expected to take 2-4 years, depending on how severely a colony is affected.

CONCLUSION: From 100 to 1,000 California brown pelicans are expected to be oiled, with death occurring in 20 to 50 percent of those contacted; recovery is expected in 2 to 4 years. No impacts on bald eagles or light-footed clapper rails is expected. Assuming that oil would contact the California least tern, this will result in injury and mortality of adults, with corresponding disruptions in reproduction and loss of young. Loss of up to 50 pairs (5% of the population) and the complete disruption of the colony's reproductive cycle for that year is anticipated with recovery expected to take 2 to 4 years.

Nonendangered Species: In southern California (a shorebird wintering area) shorebirds are most common along the coast from August through March. If an oil spill were to contact a sandy beach, where shorebirds are less common during that period, relatively few shorebirds would probably be killed. However, if an estuary or marsh, where shorebirds are usually more abundant, were contacted, mortality probably would be much higher involving several hundred birds. Loons, grebes, diving ducks, and small numbers of geese that seasonally occupy California coastal waters are expected to sustain losses associated with an oil spill requiring no more than one generation (2 to 4 years) for recovery. Seabirds occupying colonies along the California coast are expected to sustain losses requiring at least three generations (12 years) for recovery to the initial population status.

CONCLUSION: Assuming oil contact with the shoreline, injury and mortality of shorebirds are expected to occur, involving a few to as many as 500 individuals, with recovery occurring in 1 to 2 years. Recovery of waterfowl from oil spill impacts is expected to require 2 to 4 years. Seabird mortality associated with an oil spill is expected to require at least 12 years for recovery.

(f) Impacts on Fish Resources

1) Gulf of Mexico Region

It is assumed that some spilled oil (from the four tanker spills contacting the coasts of Texas and Louisiana) will penetrate into estuaries and that spilled oil will contact and affect about 60 ha of estuaries. However, it is expected that this spilled oil will not contact the endangered Gulf sturgeon due to their limited home range.

Some lethal and sublethal effects on nonendangered fish resources are expected from the oil spills. However, changes to fish resources are expected to be undetectable as regards estuary-dependent species such as menhaden, shrimp, blue crabs, scianids, mullets and oysters, to pelagic species such as mackerels, cobia, bluefish, amberjack and dolphin fish, and to reef fish species such as grouper, snapper, gag, scamp and seabass. Any loss of fish resources will be replaced through natural recruitment from the next generation.

CONCLUSION: No impacts are expected on the endangered Gulf sturgeon. Changes on nonendangered fish resources are expected to be undetectable and any loss will be replaced through natural recruitment from the next generation.

2) Pacific Region

The tanker spill will cause some local fish populations to experience sufficient egg and larvae death to result in a temporary population decrease, requiring at least one full breeding cycle to recover to its pre-spill size. On a regional level, the effects of the spill on fish populations are expected to be inconsequential. Spill caused mortalities are expected to be indistinguishable from natural fluctuations of population numbers.

A 30,000 bbl spill during the winter or spring which contacted one or more dense spawning schools of anchovy, herring or squid could directly affect local populations, possibly killing enough individuals within the affected area to cause a measurable reduction (less than 10%) in the regional population size. Locally, particularly in densely populated shallow near-shore areas, predator species could experience a slight decline in population size as a response to the change in the availability of these forage species. Impacts to local anchovy, herring and squid populations are likely to be temporary (less than 2 years) as replacement stock will arrive quickly from abundant and mobile stocks from unaffected areas of the region. Regional predator populations would not change noticeably.

Since Pacific salmon stock are small in southern California and are migratory with limited time in a given ocean area, the probability of being contacted by the oil spill for an extended period of time is very low. The spill, either offshore or coastal, would contact only a small portion of the pelagic salmon habitat. It is expected that the oil spill would contact salmon in the ocean and result in very low lethal (less than 10%) or sublethal effects that would not be discernable from natural variations of salmon typical of the area.

It is expected that an oil spill will affect steelhead trout either in spawning streams or while they are offshore. Since only a small portion of the population would be contacted by the spill, impacts from a contact offshore is expected to result in very low lethal or sublethal effects that would not be discernable from natural variations of steelhead populations typical of the area. The tanker oil spill contacting the entrance of a steelhead stream in San Luis Obispo County would result in a moderate reduction of 10 to 20 percent of the outmigrating population, with effects to the impacted year class lasting 2 to 4 years. Regional impacts would be less, since not every stream would be affected and would not be discernible from natural variations of steelhead populations in the area.

Pacific whiting eggs and larvae are widely distributed throughout southern California, occurring primarily offshore rather than in nearshore waters, and are most abundant at depths well below the water surface (approximately 50 m). It is highly unlikely that an oil spill in southern California would contact and impact a substantial portion of these sensitive life stages. Pelagic juvenile and adult whiting also occur throughout southern California, but neither a substantial portion of the subpopulation nor its prey are likely to come in contact with the oil spill, since they normally occur at depths well below the water surface (90 - 100 m in daytime to 20 - 40 m at night) and are widely dispersed offshore. Thus, such an oil spill is not expected to cause measurable reductions in the abundance of whiting populations.

CONCLUSION: For the fish resources it is expected that there would be lethal (less than 10%) or sublethal effects locally in the area of contact. Recovery of affected local populations would occur within 2 years. Regionally, lethal or sublethal effects would not be discernable from natural variations of fish populations within the area.

For Pacific salmon, it is expected that there would be very low (less than 10%) or sublethal effects that would not be discernable from natural variations of pelagic offshore salmon.

For steelhead trout, assuming that the spill contacts the entrance of a steelhead spawning stream in San Luis Obispo County, it is expected that there would be a reduction of 10 to 20 percent of the outmigrating population, with effects to the impacted year class lasting 2 to 4 years. Regional impacts would not be discernable from natural variations of steelhead trout populations in the area. For Pacific whiting it is expected that there would be very low lethal or sublethal effects that would not be discernable from natural variations of whiting populations both locally and regionally.

(g) Impacts on Reptiles

1) Gulf of Mexico Region

The effects on threatened or endangered marine turtles from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths due to spilled oil will be replaced through natural recruitment from the next generation. It is expected that the effects from oil spill response activities would be sublethal to marine turtles causing avoidance of about 200 ha of oiled coastal areas for 1 month.

CONCLUSION: It is expected that there will be no discernible decline in a threatened or endangered marine turtle population or species, and no change in distribution or abundance. Dead turtles will be replaced through natural recruitment from the next generation and any sublethal effects will last less than one generation.

2) Pacific Region

The low marine turtle densities in the southern California area make it unlikely that these animals would be affected by the assumed spill; if mortality does occur, it is not expected to be distinguishable from natural variability within the species populations.

CONCLUSION: No discernible impacts are expected on the threatened or endangered marine turtle distribution or abundance.

(h) Impacts on Coastal Habitats

1) Gulf of Mexico Region

WETLANDS: Assuming that 65 percent of the original volume of oil reaches the coast, and that 67 percent of that volume contacts wetlands (the other 33 percent contacts barriers, sea walls, and other coastal features), nearly 6,000 bbl of oil per spill will contact wetlands. Assuming that a 20 m deep section along 25 km of shoreline is contacted, the concentration of oil on the 50 ha of contacted wetland vegetation will be about 1.8 l/m^2. This concentration of oil is above the level that is believed to result in extensive mortality to wetland vegetation (Webb et al., 1985). Within this area of contact, plant regrowth is expected to occur within one growing season from the rhizomes and roots of the wetland plants over 67 percent of the area. The remaining areas will experience complete plant mortality, and will eventually be revegetated by rhizome expansion from more intact wetland areas or from reseeding. This process will take 1 to 3 years. Within the 50 ha area of contact, some of the wetland areas will be permanently lost as a result of erosion along the shoreline margins (as noted by Alexander and Webb, 1987), and as a result of an acceleration of local land loss rates in areas affected by spills (as noted by Fischel et al., 1989). It is estimated that about 5 ha of wetlands will be permanently converted to open water as a result of each spill. The total impact from the four import tanker spills will include 200 ha of wetlands experiencing temporary plant die back (one to three growing seasons) and 20 ha of wetlands being permanently converted to open water.

BARRIER BEACHES: Of the seven 30,000 bbl import spills that are estimated to occur Gulfwide, it is assumed that four will occur in nearshore, coastal waters, with one contacting barrier beaches along the west-central Louisiana coast, and two contacting barrier beaches in the vicinity of Galveston Island, Texas, based on the locations of refinery facilities in the Gulf. Assuming that 65 percent of the original volume of oil reaches the coast, and that 67 percent of that volume contacts barriers, over 13,000 bbl of oil per spill will contact beaches. Assuming that 50 km of coastline is contacted, and that the oil is washed 10 m up the beach face, a 0.4 cm thick layer of oil will be deposited on the contacted beach. Assuming a porosity of 50 percent for beach sand, the oil should penetrate into the beach to a depth of a few centimeters. By the time that beach cleanup operations begins, the oil may penetrate to depths of 6 to 8 cm. This depth of sand would have to be disturbed to remove the oil. The removal of 6 to 8 cm of sand from the littoral zone could result in beach face retreat and erosion as an adjustment to a reduced sand supply, especially along the eroding, sediment starved stretches of coast in the Gulf, such as in coastal Louisiana. This analysis, however, assumes that the sand will be cleaned in place with little to no removal of sand from the littoral zone. If this were done, the spill and associated cleanup could result in short-term adjustments in beach profile configuration, but the per-spill configurations would be reestablished within a year.

CONCLUSION: It is expected that 200 ha of wetlands will experience temporary plant die back, and 20 ha of wetlands will be permanently converted to open water as a result of import tanker crude oil spills. It is expected that oil spill cleanup operations as a result of import tanker oil spill contacts along barrier beaches will result in short term (about one year) changes in barrier beach configuration.

2) Pacific Region

ESTUARIES: Assuming that a 30,000 bbl oil spill enters an estuary and remains for several tidal cycles, impacts could involve destruction of a major part of the community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery would require at least 5 years. If a smaller portion of the estuary is covered by oil and does not penetrate into the sediments, such as might occur if the oil remains for no more than a couple of tidal cycles, impacts would likely be less severe. Mortality of a noticeable segment of the benthic community could occur along with alteration of some ecological relationships, but recovery could occur within 2 years.

CONCLUSION: Impacts of a 30,000 bbl spill entering an estuary and remaining for several tidal cycles are expected to involve destruction of a major portion of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery is expected to require at least 5 years. Regional impacts are expected to involve a decrease of several populations in local estuarine communities, but with no measurable interference with ecological relationships in the Southern California Planning Area.

(i) Impacts on Seafloor Habitats

1) Gulf of Mexico Region

CHEMOSYNTHETIC COMMUNITIES, TOPOGRAPHIC FEATURES, LIVE BOTTOMS: Because of the water depths of these features, oil from surface spills will not contact these habitats.

CONCLUSION: No impacts are expected on the chemosynthetic communities, topographic features, and live bottoms in the Gulf of Mexico.

2) Pacific Region

INTERTIDAL BENTHOS: It is assumed that a 30,000 bbl spill will contact major isolated rocky intertidal areas of Point Dume, Palos Verdes, or Newport to Dana Point and cause noticeable mortality and alteration of ecological relationships within the rocky intertidal community. Recovery could be retarded in some species for a year and different assemblages within the community could require at least 6 years to return to pre-spill conditions. Similar impacts could occur if such a spill contacted the more biologically sensitive rocky intertidal habitats in the Point Conception - Point Buchon area and the Channel Islands. Noticeable mortality of much of the community would occur with recovery requiring, possibly up to 10 years.

The impacts of a spill on sandy beach intertidal communities would include smothering and immobilization of species. Recovery of the sandy beach biota is expected to occur in less than 1 year since most of the sandy beach communities contain fast-growing and highly mobile organisms that have adapted to the constant physically disturbed environment of shifting sands (ADL, 1985; Chambers Group, Inc., 1986). Such impacts would be limited to local sandy beach habitats with little to essentially no impacts considering the region as a whole due to rapid recovery and to the low numbers of organisms affected.

SUBTIDAL BENTHOS: Assuming that hard bottoms or shallow near-shore areas are contacted by the tanker spill, noticeable mortality, involving thousands of individuals, of the community contacted could cause alterations of ecological relationships lasting for at least 2 years. Recovery would be slower and impacts higher if a species that has an important community function is destroyed on a particular rocky bottom substrate. The community may be altered until the population of the impacted species is replaced by brood stock from other areas. Functionally, oil contact with a few of these communities would not cause interference with regional ecological relationships or population levels.

CONCLUSION: With regard to the intertidal benthos, it is expected that there would be smothering and immobilization to portions of local sandy beach populations of several species limited to the area contacted by the spill with recovery occurring within a year. On rocky intertidal areas this will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community limited to the area contacted by the spill. Recovery could be retarded in some species for a year and different assemblages within the community could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis.

With regard to the subtidal benthos, it is expected that there would be loss or functional disruption of a few assemblages or communities at local areas within the region. A spill contacting one or more of the relatively few hard bottom communities would result in noticeable mortality of the hard bottom community contacted causing alterations of ecological relationships lasting for at least 2 years.

(j) Impacts on Coastal Communities

1) Gulf of Mexico Region

EMPLOYMENT AND DEMOGRAPHY: It is assumed that two spills (1,000 bbl or greater) would contact the Texas coastline (Houston/Galveston area) and two of the same size class will contact the Louisiana coastline (Mississippi River Ports/LOOP facility). It is also assumed that one of the spills contacting the Texas coast and one of the spills contacting the Louisiana coast will each affect 50 km of recreational beaches and involve substantial employment cleanup operations. For every kilometer of coastline subjected to heavy oiling, it is estimated that approximately 100 temporary workers will be employed for a maximum of six weeks in the cleanup effort — the total effort being equivalent to approximately 1,200 person-years of employment.

CONCLUSION: It is projected that employment resulting from oil spill cleanup activities will be approximately equivalent to 1,200 person years of employment. However, it is expected that employment demands in support of this activity will not involve a permanent increase in labor force nor population in the Gulf of Mexico.

PUBLIC SERVICES AND COMMUNITY INFRASTRUCTURE: Under the no action scenario, there would be a decline in the number of persons employed in the OCS oil and gas industry. This decline in employment would likely result in some out-migration from coastal parishes and counties. It is assumed that the areas most highly involved in the OCS oil and gas industry would be the most affected. Impacts from the no action alternative would, therefore, affect the northcentral Gulf coastal areas to a greater degree than the northwestern Gulf, and would impact the northeastern Gulf least of all. Impacts to public services and community infrastructure would include increased stress on public services as the number of unemployed increased, and a decrease in the support of existing infrastructure as the tax base and population decreased. It is assumed that two oil spills (1,000 bbl or greater) will contact the Texas coastline (Houston/Galveston area) and two of the same size class will contact the Louisiana coastline (Mississippi River Ports/LOOP facility). Spills of this size are not expected to result in stress on public services and infrastructure for a period of more than 6 weeks in the affected coastal areas.

CONCLUSION: Under the Alternative II, increased stress on public services would be expected as the number of unemployed persons increased. Declines in population and tax base are likely to decrease the support of currently existing infrastructure.

SOCIAL PATTERNS: Under the no action scenario, the decline in employment in the OCS oil and gas industry would likely result in some out-migration from coastal parishes and counties most heavily involved in OCS oil and gas activities. It is assumed that the most heavily impacted areas would occur in coastal Louisiana, with lesser impacts in Mississippi, Alabama, Texas, and Florida. Some impact to family life, in individual cases, could occur as a result of emotional stress associated with separation from the extended family. Impacts to traditional occupations could occur as a result of an increased number persons engaging in such traditional occupations as fishing, shrimping, and trapping. If the increase in participants in these natural resource exploitative activities is greater than the ability of the resource to sustain such activity, overfishing could occur. This could result in the eventual loss of such traditional occupations. It is assumed that two oil spills (1,000 bbl or greater) will contact the

Texas coastline (Houston/Galveston area) and two of the same size class will contact the Louisiana coastline (Mississippi River Ports/LOOP facility). Spills of this size may result in short term, limited effects on traditional occupations in a restricted area. Some impacts to family life may also occur within the limited geographical areas affected by the presumed spills.

CONCLUSION: Under Alternative II, deleterious impacts to family life are expect to occur in individual cases, and the loss of traditional occupations could occur.

2) Pacific Region

EMPLOYMENT AND DEMOGRAPHY: It is assumed that the one tanker oil spill would contact about 50 miles of the coast and involve some employment opportunities in cleanup operations. For every mile of coastline oiled, it is estimated that approximately 100 temporary workers would be employed for a period of about 30 days in the cleanup effort — the total effort being equivalent to approximately 400 person-years of employment.

LAND USE, PUBLIC SERVICE/WATER SUPPLY: Some disruption in public services may occur for the duration of cleanup activities (up to 2 months) due to an oil spill as public agencies divert some of their resources to provide cleanup assistance. Water supply systems may also be adversely affected during cleanup activities.

VESSEL TRAFFIC: Ship traffic may be rerouted around the one spill for the duration of at-sea cleanup activities (which could be as long as 2 months). Rerouting would be an inconvenience to shipping transiting the area, and would result in some expenses due to additional travel time, fuel, and labor costs. In addition, there would be costs associated to damage to fishing and recreational boats, if oil contacted any vessel in the area.

CONCLUSION: It is projected that employment resulting from oil spill cleanup activities will be approximately equivalent to 400 person years of employment. However, it is expected that employment demands in support of this activity will not involve a permanent increase in labor force nor population in the Pacific Region. Some impacts are expected on land use and public service/water supply aspects. It is expected that normal ship traffic would be rerouted for 1 to 2 months around the spill cleanup area resulting in additional travel time, fuel,and labor costs to the affected parties.

(k) Impacts on Fisheries

1) Gulf of Mexico Region

COMMERCIAL FISHING: Of the four spills assumed (1,000 bbl or more) to contact the Texas and Louisiana coasts it is assumed that some of the spilled oil will penetrate into estuaries. It is estimated that this oil will contact approximately 60 ha of estuaries. Both lethal and sublethal effects on commercial fisheries resources and depression of commercial fishing activities will result because of the estuarine dependance of the affected fish species. Affected species may include, for example, menhaden, blue crabs, scianids, mullet and oysters. This would result in 0.01 to 0.1 percent economic loss to commercial fisheries of estuarine dependent species for one to two fishing seasons.

RECREATIONAL FISHING: Seven import tanker spills (30,000 bbl) will temporarily discourage offshore fishing and lead to a loss of fishing activity and a decline in the sale of fishing equipment, supplies and services within the coastal communities impacted. The lack of fishing activity and the loss of sales of fishing equipment, supplies and services caused by oil pollution will not extend beyond the communities impacted or the days or weeks it takes to clean up the spill. The marine recreational fishing industry is expected to continue its growth and expansion in the Gulf in direct association with continued and expanded economic development and population increases.

CONCLUSION: It is expected that there would be a 0.01 to 0.1 percent economic loss to commercial fisheries of estuarine dependent species for one to two fishing seasons (1-2 years). For the recreational fishery, it is expected that there will be disruption on fishing activities in the offshore areas directly affected, and that this may lead to a decline in the sale of fishing equipment, supplies, and services for up to one fishing season when large quantities of spilled oil come ashore in coastal fishing communities.

2) Pacific Region

COMMERCIAL FISHING: Contact of a tanker spill with important fishing areas could cause tainting of fisheries resources or contamination of fishing gear, causing fishermen to sustain economic losses for about 1 month or as long as it takes time to clean their gear. A tanker spill could prevent fishermen from leaving port because of oil containment booms. This could cause fishermen to sustain complete economic losses during the period of time that the booms are in place (about 1 month). The consequences of an oil spill to the regional fishing industry would be most severe if oil contacted Los Angeles and Long Beach Harbors and port closure resulted.

Reductions of catches as a result of the tanker spill could also cause the Santa Barbara subregion to experience a number of impacts, including high economic losses for two seasons ranging from 20 to 30 percent, and more than 10 percent unemployment among fixed-gear fishermen.

CONCLUSION: It is expected that there will be high economic losses ranging from 20 to 30 percent lasting for two seasons. There would be more than 10 percent unemployment of the fixed-gear fishermen and financial losses of 10 to 20 percent of economically dependent businesses.

RECREATIONAL FISHING: It is expected that the tanker oil spill assumed to occur in the Southern California Planning Area will contact a harbor where sport boat operations concentrate. Operators of commercial fishing vessels and skiff rental facilities may sustain local, temporary (about 1 month) economic losses (10 to 20 percent). Regionally, economic costs to the sportfishing industry due to the oil spill are expected to be minimal because of the large area involved and the number of harbors that are likely to be unaffected by the spill. Since local and regional fish populations are not expected to be reduced, fisheries resources available to sportfishermen will remain unchanged.

CONCLUSION: It is expected that the spilled oil would contact one harbor used by sport fishermen resulting in local economic losses of 10 to 20 percent over a period of approximately a month. No discernable areawide impacts are anticipated due to the number of harbors that would not be affected by the spill.

(l) Impacts on Subsistence

PACIFIC REGION: A large spill contacting important rocky intertidal gathering areas near large population centers is expected to reduce for up to a year the availability and/or desirability of one or more species important for subsistence gathering.

CONCLUSION: It is expected that local intertidal gathering areas would experience a reduction in one or more important species for up to a year.

(m) Impacts on Archaeological Resources

1) Gulf of Mexico Region

The impact from the oil spill contact on a historic coastal site, such as a fort or lighthouse, would be visual due to oil contamination. This impact would be temporary (lasting up to weeks) and reversible. Contact of the oil with a coastal prehistoric site would preclude dating the site, using radiocarbon methods, because of the contamination. Oil spill cleanup operations could also physically impact coastal prehistoric sites and unique or significant archaeological information could be lost.

CONCLUSION: It is expected that a prehistoric archaeological site containing significant but not unique information would be disturbed to an extent that the site loses at least one but not all the physical features which would yield scientific information.

2) Pacific Region

As a result of the oil spill contact with the shoreline there may be temporary degradation of the viewshed of historic and prehistoric sites in the contact area for the duration of the spill. It is anticipated that spill cleanup operations will take a few weeks to a month. Once the cleanup is completed, the viewshed is expected to return to its pre-spill state.

CONCLUSION: It is expected that the viewshed of onshore prehistorical or historical sites would be temporarily degraded during the spill and associated cleanup activities (a few weeks to 1 month).

(n) Impacts on Recreation and Tourism

1) Gulf of Mexico Region

It is assumed that of the seven tanker spills Gulfwide, one of the spills contacting the Texas coast and one contacting the Louisiana coast will each affect 50 km of recreational beaches. These spills are expected to lead to closure of beach and park areas along the coasts of Louisiana and Texas for up to 6 weeks. It is anticipated that this closure will occur during 4 of the 45 years of the project life in an area extending from Grand Isle, Louisiana to Galveston, Texas. Tourist losses associated with these closures will be local and represent less than 10 percent of projected economic gains.

CONCLUSION: It is expected that there would be closure (less than a full season or approximately 6 months) at a few parks and recreation areas during 4 of the 45 years of the project life. Tourist losses associated with these closures will be local and represent less than 10 percent of projected economic gains.

2) Pacific Region

Impacts to recreational resources from the one tanker spill include closure of the affected beach for approximately 1 month, temporary displacement of resource users to unaffected sites, financial losses to local merchants servicing the contaminated area, and temporary degradation of aesthetic qualities of the spill site. These impacts are expected to continue for the duration of cleanup operations, approximately one month.

CONCLUSION: It is expected that there will be closure of recreation facilities at the oil spill affected coastal site for one month. Recreation resource users will be temporarily displaced and local merchants deriving income from those users will experience an economic loss.

(2) Impacts Due to Increased Domestic Onshore Gas Production

Increased domestic onshore gas production, primarily from tight sands and coalbed methane production, represents 44 percent of the replacement for OCS produced natural gas shown in Table IV.D.1.a-1 for the proposed action (base case). The impacts associated with these unconventional recovery methods and pipeline transport have been summarized earlier (Section IV.D.2.a(1)) and discussed in detail in Appendix C. In contrast to OCS gas development, the impacts expected from these procedures are essentially on land rather than offshore.

The coalbed methane resource occurs basically within 13 major coal-bearing basins in the lower 48 states, primarily in the Rocky Mountains (Montana south to Colorado) and the Appalachians (Pennsylvania south to Alabama) regions. Commercial methane gas production has been documented in the San Juan Basin (New Mexico, Colorado), Warrior Basin (Alabama), and Northern Appalachian Basin (Pennsylvania, West Virginia, Ohio) (Rightmire et al., 1984) The tight gas sands resource occurs within 23 basins/trends in the lower 48 states. These encompass a wide variety of geologic environments over a large geographic area including generally the Rocky Mountains, southwestern and southeastern United States, Ohio Valley and Appalachian regions (O'Shea and Murphy, 1987).

The impacts from gas production via tight sands and coalbed methane production were examined under the general headings of air, water, land and societal effects. The findings are as follows. **Air Impacts**: Noise and regulated pollutant emissions result from support equipments and from venting and flaring of natural gas during excavation and initial production. These emissions contribute to greenhouse gases, potentially add to acid rain and tropospheric ozone, and may have a negative impact on stratospheric ozone. **Water Impacts**: Discharge of produced water, which is elevated in salt, trace metals, solids, etc., can degrade surface and groundwater quality and uses. Hydraulic fracturing may result in disruption and potential contamination of aquifers. **Land Impacts**: Land disturbance occurs due to site preparation at drilling locations (typically 3 acres are cleared, graded and leveled per deep-well location) and establishment of holding ponds for wastes like drill muds and cuttings. These activities result in soil erosion, vegetation destruction, ecosystem disturbance, and potential effects on wetlands. **Societal Impacts**: There is some loss of the "scenic environment" due to loss of natural vegetation. Also, there is increased risk of exposure by workers to toxic chemicals added to the fracturing fluids.

3. Alternative III — Slow the Pace of Leasing

Alternative III provides for no more than 15 sales in 12 of the planning areas (see Table II.C.1-1). The timing and number of sales in Alternative III allows for a slower pace of leasing in the Western, Central and Eastern Gulf of Mexico, the Beaufort Sea and Chukchi Sea, and Mid- and South Atlantic Planning Areas. The amount of acreage being considered for lease is also reduced in the Mid- and South Atlantic (22 blocks) and the Eastern Gulf of Mexico Planning Areas (approximately 897 blocks).

RESOURCE ESTIMATES: Resource estimates for Alternative III are presented in Table IV.D.3-1. Section IV.D.1.a provides a discussion on the PRESTO model used to calculate the resource estimates that are assumed to be leased, discovered, and produced.

Table IV.D.3-1. Conditional Resource Estimates — Slow the Pace of Leasing

REGION AND PLANNING AREA	OIL (BBO)	GAS (TCF)	MPHC
GULF OF MEXICO REGION			
Western Gulf of Mexico	0.20	3.19	1.00
Central Gulf of Mexico	0.52	5.17	1.00
Eastern Gulf of Mexico	0.02	0.22	1.00
ALASKA REGION			
Beaufort Sea	0.30	—	0.16
Chukchi Sea	1.17	—	0.21
Hope Basin *or*	0.24	—	<0.01
St. George Basin	0.23	—	0.02
Norton Basin *or*	0.30	—	<0.01
St. Matthew-Hall *or*	<0.01	—	<0.01
Navarin Basin	0.24	—	0.03
Cook Inlet	0.16	—	<0.01
Gulf of Alaska	0.34	—	0.04
PACIFIC REGION			
Southern California	0.33	1.01	1.00
ATLANTIC REGION			
Mid- and South Atlantic	0.04	1.62	0.63

BBO - Billion Barrels of Oil
TCF - Trillion Cubic Feet
MPHC - Marginal Probability of Commercial Hydrocarbons

EXPLORATION AND DEVELOPMENT ASSUMPTIONS: The hypothetical scenarios concerning exploration and development activities for Alternative III were developed using the same assumptions as for Alternative I (Section IV.D.1.a). The level of offshore and onshore activities are based on the amount of hydrocarbon resources assumed to be leased, developed, and produced as a result of sales in Alternative III (see Tables IV.D.3-2 and IV.D.3-3).

TRANSPORTATION AND MARKET ASSUMPTIONS: The amounts of natural gas and oil resources assumed to be leased and developed in the Western, Central, and Eastern Gulf of Mexico, Beaufort Sea, Chukchi Sea, Mid- and South Atlantic Planning Areas, and are less in this alternative

Table IV.D.3-2. Exploration And Development Activity — Slow the Pace of Leasing

Planning Area	Sales (No.)	BBOE	MP_{HC}	Exp./Del. Wells (No.)	Dev./Pro. Wells (No.)	Platforms (No.)	Years Of Activity
Western Gulf of Mexico	3	.77	1.00	890	450	45	1993-2030
Central Gulf of Mexico	3	1.44	1.00	1240	900	90	1994-2031
Eastern Gulf of Mexico	1	.04	1.00	60	20	4	1998-2036
Beaufort Sea	1	.30	0.16	7	40	2	1994-2019
Chukchi Sea	1	1.17	0.21	27	156	4	1995-2023
Hope Basin *or*	1	.24	<0.01	8	34	1	1996-2021
St. George Basin	1	.23	0.02	8	50	1	1996-2021
Norton Basin *or*	1	.30	<0.01	11	66	1	1997-2022
St. Matthew-Hall *or*	1	<.01	<0.01	6	—	—	1997-1999
Navarin Basin	1	.24	0.03	8	48	1	1997-2022
Cook Inlet	1	.16	<0.01	6	26	1	1995-2019
Gulf of Alaska	1	.34	0.04	11	53	1	1996-2021
Southern California	1	.51	1.00	25	150	7	1998-2030
Mid- and South Atlantic	1	.33	0.63	25	79	4	1995-2020

MP$_{HC}$ - Marginal Probabilty Of Commercial Hydrocarbons
BBOE - Billion Barrels of Oil Equivalent

than in the proposal. However, the basic assumptions used in Alternative I concerning how gas and oil production will be transported to shore (Section IV.D.1.a) are still valid. It is also assumed that the amount of natural gas and oil that would be forgone as a result of the adoption of Alternative III would be replaced by the importation of foreign oil by tankers (see Section IV.D.2). The likely mix of market-driven replacements for the forgone hydrocarbons is shown in Table IV.D.2-1. The imported oil replacing the forgone OCS natural gas and crude oil would represent approximately 1,750 trips by a 100,000 dwt tanker to ports in the Gulf of Mexico Region, and approximately 400 trips by a 30,000 dwt tanker to ports in the Atlantic Region.

OIL SPILL ASSUMPTIONS:

Oil Spills Greater Than or Equal to 1,000 bbl. Table IV.D.3-4 presents the number and type of oil spills assumed to occur as a result of OCS activity associated with Alternative III. The source and number of assumed spills were based on the volume of oil listed in Table IV.D.3-1, assumptions on the mode of transportation, and spill rates for spills greater than or equal to 1,000 bbl (see Section IV.D.1.a).

Table IV.D.3-5 presents the probabilities of one or more spills of 1,000 bbl or greater and 10,000 bbl or greater occurring. These probabilities are based on the total estimated mean number of spill assumed to occur as a result of oil production from the adoption of Alternative III. It is also assumed that these spills would occur with uniform frequency over the life of the alternative.

Table IV.D.3-6 presents the assumed locations of the tanker spills along the tanker routes. Tanker spills resulting from production in the Beaufort and Chukchi Sea Planning Areas are assumed to occur outside of those planning areas. Oil produced in the Beaufort and Chukchi Sea Planning

Table IV.D.3-3. New Offshore and Onshore Infrastructure — Slow the Pace of Leasing

Planning Area	Platforms (No.)	Oil and Gas Pipelines[3,6,7,8] (No.)	Oil and Gas Pipelines[7,9] (Miles)	Pipeline Landfalls (No.)	Shore Bases/ Support Facilities (No.)
Western Gulf of Mexico	45	–	995	2	2[1]
Central Gulf of Mexico	90	–	1140	2	2[2]
Eastern Gulf of Mexico	4	–	425	–	–
Beaufort Sea	2	–[4]	200	1	1[5]
Chukchi Sea	4	–[4]	150	1	1[5]
Hope Basin *or*	1	1	90	1	1[5]
St. George Basin	1	–	–	–	1[5]
Norton Basin or	1	–	–	–	–[5]
St. Matthew-Hall *or*	–	–	–	–	1
Navarin Basin	1	–	–	–	–
Cook Inlet	1	1	25	1	1[5]
Gulf of Alaska	1	1	100	1	1[5]
Southern California	7	14	50	–	–
Mid- and South Atlantic	4	3	500	3	6[10]

1. Gulf of Mexico Region - additional support facilities: 2 new marine terminals.
2. Gulf of Mexico Region - additional support facilities: 1 new marine terminal and 1 new pipeline yard.
3. Alaska Region - oil pipelines only.
4. Alaska Region - offshore gathering system.
5. Shorebases can include tank farms, docks, air bases, utilities, supply depots and personnel quarters.
6. Pacific Region - total number of oil and gas pipelines.
7. Pacific and Gulf of Mexico Regions - oil and gas pipelines are layed along the same pipeline corridor.
8. Atlantic Region - gas pipelines only.
9. Atlantic Region - total pipeline miles includes gathering and trunk lines.
10. Atlantic Region - additional support facilities: 2 new gas plants, 2 supply bases and 2 new heliports.

Areas would be transported by the TAPS to the Valdez terminal facilities and then transported by tanker to west coast ports. Based on the destination and amount of the TAPS oil shipped from Valdez to west coast ports (Puget Sound, Washington; San Francisco and Los Angeles, California), it is reasonable to assume that a tanker spill could occur along the tanker routes to these ports.

The probabilities of one or more pipeline or platform spills equal to or greater than 1,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 32 percent and 78 percent, respectively. The probabilities of one or more pipeline or platform spills equal to or greater than 10,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 11 percent and 38 percent, respectively. As a result of the transportation of oil from the Chukchi Sea Planning Area there is a 78-percent probability of one or more spills of 1,000 bbl or greater occurring along the tanker route. As a result of the transportation of oil from the Chukchi Sea Planning Area there is a 62-percent probability of one or more spills of 10,000 bbl or greater occurring along the tanker route. As a result of the transportation of oil from the Beaufort Sea Planning Area there is a 32-percent probability of one or more spills of 1,000 bbl or greater occurring along the tanker route. As a result of the transportation of oil from the Beaufort Sea Planning Area, there is a 22-percent probability of one or more spills of 10,000 bbl or greater occurring along the tanker route.

Table IV.D.3-4. Oil Spill Assumptions — Slow the Pace of Leasing

Planning Area	Assumed Oil Spills[3] Platform (Nos.)	Pipeline (Nos.)	Tanker (Nos.)
Western Gulf of Mexico	–	–	–
Central Gulf of Mexico		1	–
Eastern Gulf of Mexico[1]	–	–	–
Beaufort Sea	–	–	1
Chukchi Sea		1	2
Hope Basin *or*	–	–	1
St. George Basin	–	–	1
Norton Basin *or*	–	–	1
St. Matthew-Hall[2] *or*	–	–	–
Navarin Basin	–	–	1
Cook Inlet	–	–	1
Gulf of Alaska	–	–	1
Southern California	–	1	–
Mid-and South Atlantic[1]	–	–	–

1. No spill was assumed — total estimated mean number of spills was <0.01 - Eastern Gulf of Mexico and 0.07 - Mid- and South Atlantic.
2. No spill was assumed — exploration activity only.
3. Based on the total estimated mean number of spills greater than or equal to 1,000 bbls.

Table IV.D.3-5. Oil Spill Probabilities — Slow the Pace of Leasing

Planning Area	Oil (BBO)	MPHC	Probability of 1 or more spills occurring 1,000 bbl or greater	10,000 bbl or greater
Western Gulf of Mexico	0.20	1.00	23%	8%
Central Gulf of Mexico	0.52	1.00	49%	18%
Eastern Gulf of Mexico	0.01	1.00	1%	< 1%
Beaufort Sea	0.30	0.16	53%	31%
Chukchi Sea	1.17	0.21	95%	76%
Hope Basin *or*	0.24	<0.01	47%	27%
St. George Basin	0.23	0.02	37%	21%
Norton Basin *or*	0.30	<0.01	34%	25%
St. Matthew-Hall *or*	<0.01	<0.01	—	—
Navarin Basin	0.24	0.03	34%	21%
Cook Inlet	0.16	<0.01	34%	18%
Gulf of Alaska	0.34	0.04	59%	34%
Southern California	0.33	1.00	34%	14%
Mid-and South Atlantic	0.04	0.63	7%	4%

BBO - Billion Barrels of Oil

Table IV.D.3-6. Oil Spill Assumptions — Slow the Pace of Leasing Assumed Location of Tanker Spills

Location of the Tanker Spill	Assumed Tanker Spills (Nos.)
Hope Basin *or*	1
St. George Basin	1
Norton Basin *or*	1
Navarin Basin	1
Cook Inlet	1
Gulf of Alaska	2
Washington and Oregon	1
Southern California	1

As a result of the importation of foreign oil to replace the forgone OCS natural gas and oil, it was assumed that two tanker spills greater than or equal to 1,000 bbl would occur in the Gulf of Mexico Region. Since the estimated mean number of spills associated with the importation of foreign crude oil was less than 0.07 in the Atlantic Region, no spill was assumed for these imports in the Atlantic. It is assumed that the substitute import spills and spills assumed to occur as a result of Alternative III would occur with uniform frequency over the life of the alternative.

Oil Spills Greater Than 1 bbl and Less Than 1,000 bbl. Table IV.D.3-7 presents the estimated mean number of spills assumed to occur as a result of the adoption of Alternative III. Assumptions used in the calculation of small spills are presented in Section IV.D.1.a.

Table IV.D.3-7. Small Spill Assumptions — Slow the Pace of Leasing

Planning Area	Assumed Small Spills $>1 \leq 50$ bbl[1]	Assumed Small Spills $>50<1{,}000$ bbl[2]
Western Gulf of Mexico	27	1
Central Gulf of Mexico	70	3
Eastern Gulf of Mexico	1	–
Beaufort Sea	76	3
Chukchi Sea	297	12
Hope Basin *or*	61	2
St. George Basin	58	2
Norton Basin *or*	76	3
St. Matthew-Hall *or*	–	–
Navarin Basin	61	2
Cook Inlet	41	2
Gulf of Alaska	86	3
Southern California	24	1
Mid-and South Atlantic	10	–

Small Spills Rates per billion bbls of oil produced:

1. Gulf of Mexico Region - 135; Alaska and Atlantic Regions - 253.63; Pacific Region - 72.65
2. Gulf of Mexico Region - 5 ; Alaska and Atlantic Regions - 10.25; Pacific Region - 2.14

a. Impacts on Water Quality

(1) Gulf of Mexico Region

As a result of this alternative, it is estimated that there will be a reduction in OCS activities (including discharges) relative to Alternative I which correspond to the reduced resource discovery and production. The greatest reduction in offshore exploration and production and associated infrastructure support would occur offshore Florida. In this area, 50+ percent of the activities estimated to support the proposal would be forgone, along with a corresponding reduction in effluent discharges. Immediate effects would be brought about by increased drilling, construction and pipelaying activities, causing an increase in water column turbidities (lasting for several hours with mud discharges to several weeks with dredging-pipelaying activities) to the affected offshore waters. The magnitude and extent of turbidity increases would depend on the hydrographic parameters of the area, nature and duration of the activity, and bottom-material size and composition. As indicated in the Alternative I analysis, offshore Texas would receive the greatest portion of program-related pipeline burial activities, whereas, offshore Louisiana would receive the largest amounts of program-related operational discharges. Because of the continuous nature of oil and gas activities in the northwestern and northcentral Gulf of Mexico, the frequency of drilling mud and cutting and produced water discharges is judged to occur nearly continuously throughout these areas.

Under Alternative III produced water discharges (approximately 792 million bbl) will be rapidly diluted offshore within the immediate vicinity of the discharge source. Another 97.8 million bbl of produced waters would be transported ashore for separation, treatment, and disposal. Significant increases in water concentrations of dissolved and particulate hydrocarbons and trace metals are not expected outside the initial mixing zone or immediate vicinity of the discharge source. Higher concentrations of trace metals, salinity, temperature, organic compounds, and radionuclides, and lower dissolved oxygen may be present near the discharge source. Long-term effects to water column processes, consisting of localized increases in particulate metal and soluble lower molecular weight hydrocarbons (e.g., benzene, toluene, and xylenes) concentrations, may be implicated within the mixing zone of the discharge. Trace metals and hydrocarbons associated with the discharge may be deposited within sediments near the discharge point. The proposed discharge of 20.5 million bbl of drilling fluids and 6 million bbl of drill cuttings would encounter rapid dispersion in marine waters. Discharge plumes will be diluted to background levels within a period of several hours and/or within several hundred meters of the discharge source. The accumulation of toxic trace metals and hydrocarbons in exposed shelf waters, due to periodic releases of water-based generic muds and cuttings, are unlikely and the long-term degradation of the water column from such discharges are not major concerns. Eighteen percent or 4.5 million bbl of drilling fluids (muds) would be transported onshore for disposal.

Three oil spills (greater than or equal to 1,000 bbl) would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. The projected tanker spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000 bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. It is estimated that the pipeline spill will contact and affect 50 km of beach, 25 km of inshore shoreline, and 16 ha of estuaries/wetlands. Booming would serve to preclude impacts to most estuarine waters there. No oil spills greater than 50 bbl and less than 1,000 bbl are assumed to impact coastal and nearshore waters. However, several spills (greater than one and less than or equal to 50 bbl) are likely to result from OCS program-related activities both in the coastal zone and from offshore. Few of these offshore spills will contact the Gulf's coastline, yet these spills will contact and affect 100 ha of estuaries. Program-related spills will introduce oil into nearshore and offshore waters, creating elevated hydrocarbon levels (up to 100+ug/l) within affected waters. Much of the oil will be dispersed throughout the water column over several days to weeks. In shallow areas, oil may become entrained in suspended particles and bottom sediments. Water uses would be affected for up to several weeks from proposed spills and then only near the source of slick.

CONCLUSION: As a result of Alternative III, an identifiable change to the ambient concentration of one or more water quality parameters will be evident up to several hundred meters from the source and for a period lasting up to several weeks in duration in marine and coastal waters. In poorly flushed coastal waterbodies, this change (in trace metals and hydrocarbons) may be severe, exceeding USEPA safe levels by several orders of magnitude and persisting for months or longer. Chronic, low level pollution related to the proposal will occur throughout the 45-year life of the proposal.

(2) Alaska Region

Routine activities associated with Alternative III that are likely to affect water quality are drilling and production discharges (muds and cuttings, formation waters) and construction activities (dredging, siting and platforms removal). Oil spills are the only accidental activities likely to affect water quality.

The major discharges resulting from exploration and production drilling would be muds and cuttings. Sixty seven exploration and delineation wells and 373 production wells are assumed to be drilled in the Alaska OCS as a result of Alternative III. The number of wells drilled and discharges of muds and cuttings for the Navarin Basin, St. George Basin, Cook Inlet, and the Gulf of Alaska would be the same as indicated for Alternative I. Alternative III would decrease the number of exploration/delineation and production wells drilled in the Beaufort (from 92 to 47) and Chukchi Sea (from 315 to 183) Planning Areas. For additional information on muds and cuttings see Section IV.A. Exploration discharges are not likely to exceed applicable water-quality criteria outside of a 100-m radius, or 0.03 km^2 around each drill site. The effects of exploration discharges on water quality would persist for a few hours within the 100-m radius mixing zone around each platform. The maximum area temporarily degraded at one time in the Navarin Basin, St. George Basin, Cook Inlet, and the Gulf of Alaska would be the same as indicated for Alternative I. The maximum area temporarily degraded at one time in the Beaufort Sea would be about 0.06 km^2 (1995-1996) and about 0.12 km^2 (1996-1997) in the Chukchi Sea. Alternative III discharges of muds and cuttings would degrade water quality on less than 1 percent of each planning area. Production drilling discharges would be of the same order of magnitude as exploration discharges assuming that maximum discharge rates are limited by USEPA to the same extent during production as in exploration.

Over the life of the field, the volume of formation waters produced is equal to 20 to 150 percent of the oil-output volume (Collins et al., 1983). The production of formation waters over the life of the fields in the Navarin Basin, St. George Basin, Cook Inlet, and Gulf of Alaska would be the same as indicated for Alternative I. In the Beaufort Sea, the volume of formation waters discharged would decrease from 104 to 780 MMbbl (Alternative I) to 60 to 450 MMbbl with this alternative. In the Chukchi Sea the volume of formation waters discharged would decrease from 406 to 3,045 MMbbl (Alternative I) to 234 to 1,755 MMbbl with this alternative. If formation waters were reinjected or injected into different formations, no discharge of formation waters would occur and no effect would occur. If treated formation waters were discharged, the effect on water quality would be limited to the mixing zone (100 m from the discharge point) and would continue for the duration of production in each planning area.

Under Alternative I the discharge of formation waters would degrade water quality on less than 1 percent of each planning area. Discharge of formation waters would require an USEPA permit and would be regulated so that water-quality criteria, outside an established mixing zone, would not be exceeded.Trace-metal concentrations in muds and cuttings discharges and oil and grease concentrations in formation water discharges are not likely to exceed water-quality criteria outside a 100-m radius around each drill site or production platform. The discharge of muds and cuttings and formation waters would reduce water quality on considerably less than 1 percent of the area identified under the alternative. This reduction in water quality would exist only during periods of actual discharge and would rapidly dissipate on completion of their discharge. This alternative would reduce the amount of muds and cutting and formation waters discharged in the Beaufort Sea and Chukchi Sea Planning Areas.

Sediment resuspension and bottom disturbances are likely to occur as a result of siting and removing platforms, and trenching and burial of subsea pipelines. The amount of sediment disturbance associated with platform siting, anchor setting, and drilling would be comparatively small with sediment levels likely to be reduced to background levels within several hundred meters downcurrent.This alternative would reduce the amount of offshore pipeline necessary to tie into assumed existing infrastructure in the Beaufort and Chukchi Seas. About 200 miles of offshore pipeline could be emplaced in the Beaufort Sea (275 mi in Alternative I) and 150 miles of pipeline in the Chukchi Sea (250 mi in Alternative I). This alternative would not reduce the amount of pipeline for Cook Inlet or the Gulf of Alaska. In Cook Inlet and Gulf of Alaska 25 and 100 miles of pipelines would be necessary, respectively, to connect production platforms with onshore facilities. Trenching and dumping of dredged spoils would disturb about 12 mi^2 in the Beaufort Sea (17 mi^2 in Alternative I), 9 mi^2 in the Chukchi Sea (15 mi^2 in Alternative I), 2 mi^2 in Cook Inlet, and 6 mi^2 in the Gulf of Alaska.Because dredging occurs at a rate of about 1.3 km per day, the extent of the turbidity plumes from this construction would be about 3.9 km^2 at any one time (a 1.3-km by 3-km area). Over the actual period of pipeline dredging (Beaufort Sea, 2 years; Chukchi Sea, 2 years; Cook Inlet, 1 year; Gulf of Alaska, 1 year), perhaps an equal area would be affected by turbidity from dumping on a daily basis. Dumping of dredged spoils is not expected to introduce or mobilize any chemical contaminants. In addition to permitted discharges, accidental oil spills are likely to occur. No spills of 1,000 bbl or greater are assumed in the Beaufort Sea Planning Area, one in the Chukchi Sea Planning Area; one spill each in the St. George Basin, Navarin Basin, and Cook Inlet planning areas; and two in the Gulf of Alaska Planning Area. This alternative would have two less 1,000-bbl-or-greater spills in the Chukchi Sea and one less spill in the Beaufort Sea than the proposal. In addition to the infrequent occurrence of spills greater than or equal to 1,000 bbl, 642 chronic small spills ranging from 1 to 999 bbl also would be expected.

For information on the fate and behavior of oil spills and their dissolved-hydrocarbon concentrations, see Section IV.A. Sustained degradation of water quality to levels above State and Federal criteria from hydrocarbon contamination is unlikely. Hydrocarbon concentrations from each of six oil spills of greater than 1,000 bbl could exceed the chronic criterion of 0.015 ppm total hydrocarbons on up to several thousand square kilometers for a short period of time (about 30 days). However, this would depend on the size, location, and season of the spill. The persistence of individual oil slicks would be short term (less than 1 year). The small spills under 1,000 bbl estimated to occur over the life of the fields would result in local chronic contamination.

CONCLUSION: Based on the scenario for Alternative III, trace metal and oil and grease concentrations in discharges are not expected to exceed water-quality criteria outside a 100-m radius around each drill site or production platform. Discharges would reduce water quality on considerably less than 1 percent of the area affected. This reduction in water quality would exist only during periods of actual discharge and would rapidly dissipate on completion of their discharge. Water quality on up to several thousand square kilometers is expected to be reduced by hydrocarbon contamination for a short period of time (about 30 days). The principal cause of impacts is spilled oil, and the probability is that one or more spills of 10,000 bbl or greater will occur over the 30-year life of the proposal ranges from 18 percent in Cook Inlet to 62 percent in the Chukchi Sea.

(3) Pacific Region

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Consequently, impacts on water quality in the Pacific Region under Alternative III would be slightly lower, but would not be expected to change substantially from Alternative I. Section IV.D.1.a(1) provides a discussion of potential impacts on water quality in the Pacific Region and an analysis of the impacts expected as a result of the Alternative I.

Routine operational effluents include 1) formation, or produced water; 2) drilling muds and cuttings; and 3) other routine discharges such as ballast water, cooling water, desalinization brine, excess cement, deck drainage, and treated sewage. Resuspension of bottom sediments will also occur during most routine operations. Effluents and resuspended sediments resulting from routine activities in the Pacific Region are expected to cause some mortality of marine organisms within 300 to 500 m of discharge sites and elevated levels of contaminants and turbidity above ambient levels within 1,000 to 2,000 m.

Three oil spills of 1,000 bbl or more are assumed to occur in the Pacific Region under this alternative: one off the coast of Washington, and two off southern California. Oil spills are expected to elevate hydrocarbon levels up to 100+ug/l and to limit water use in areas of 1,000-2,000 km^2 over a period of several days to weeks.

CONCLUSION: Adoption of Alternative III is expected to result in effects on water quality and water use over areas of a thousand square kilometers or more for periods of days to weeks. Oil spills are expected to be the major cause of impacts. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(4) Atlantic Region

Water quality impacts caused by routine OCS activities are analyzed in Alternative I (see Section IV.D.1.a(1)). This analysis resulted in the conclusion that offshore water quality parameters would only be affected in the immediate vicinity of discharges and would return to ambient conditions within a few hours after discharges cease. Activities at onshore support bases were also determined to have insignificant effects on inshore water quality. Under the scenario for Alternative III, no changes are expected in the causes of impacts on water quality resulting from routine onshore and offshore OCS activities compared to Alternative I (Section IV.D.1.a(1)). These causes include routine activities, construction, and maintenance at onshore support facilities, gas processing plants, and offshore wells and platforms. Discharges from offshore support vessels, while in coastal waters, construction of gas pipelines, and channel dredging are other activities that have the potential of affecting inshore water quality. Water pollution offshore is likely to be caused by discharges of drilling muds and cuttings, formation waters, and domestic and sanitary wastes.

Small operational oil spills are a likely cause of temporary and local water quality degradation in inshore waters under the scenario for Alternative III, as well as for Alternative I (Section IV.D.1.a(1)). Hydrocarbons with highly volatile fractions are likely to have the greatest effects on water quality, while the persistence of oil in the marine environment depends on the amount less volatile fractions in the oil and characteristics of the environment.

The potential impacts on water quality from routine inshore and offshore discharges are discussed under Alternative I (Section IV.D.1.a(1)). The impacts on water quality under the scenario for Alternative III are expected to be the same as those for Alternative I. Attributes of water quality that are likely to be affected by routine discharges include DO, COD, BOD, turbidity, trace metals, nutrients, salinity, radionuclides, and toxic chemicals.

Under the scenario for Alternative III, there will be a net (one-third) decrease in total offshore discharges compared to Alternative I because of the decrease in the level of OCS activities. The effects on water quality from routine offshore discharges including formation waters, domestic and sanitary wastes, and muds and cuttings are under Alternative I (Section IV.D.1.a(1)). These effects are expected to be limited to the vicinity of the discharge (1,000 m [3,280 ft]) and are expected to affect water quality parameters for a few hours or less. The impact on water quality from these discharges will be minor because of USEPA's NPDES regulations on allowable discharges, the rapid dilution and dispersion of discharges in the marine environment, and the relatively low toxicity of allowable discharges.

Inshore and offshore construction are expected to temporarily affect water quality by increasing turbidity. Effects of turbidity on water quality are described in Alternative I (Section IV.D.1.a(1)). These effects are likely to be the same under the scenario for Alternative III. Impacts on water quality due to increased turbidity are expected to last a few hours to a few days, depending on water circulation and type of bottom sediment.

Accidental discharges of small oil spills are likely to have a measurable local impact on water quality. Since most small oil spills are assumed to consist of fuel oil and are therefore highly volatile, small oil spills are expected to affect water quality for relatively short time periods (a few hours to days) depending on size of spill, volume of estuary, and tidal exchange. However, because of the high toxicity of fuel oil, these spills are likely to have a serious, although short-term (few days) effect on water quality. Factors such as turbulence and the amount and type of suspended sediment, can extend the effect of fuel oil spills on water quality from days to months.

The impacts of routine OCS discharges in the mid- and south Atlantic under the scenario for Alternative III are not likely to significantly affect onshore or offshore water quality. The most severe effects on water quality are expected to be limited to the immediate vicinity of the discharge site and would persist for not more than a few hours. More measurable effects on water quality are likely from inshore fuel oil spills.

CONCLUSION: Water pollution from routine OCS gas and oil activities under the scenario for Alternative III will not measurably degrade water quality onshore or offshore. Some water quality parameters including turbidity and hydrocarbons, are expected to be locally elevated one or two orders of magnitude for a few days or less.

b. Impacts on Air Quality

(1) Gulf of Mexico Region

Under this Alternative III, emissions of the five primary pollutants will be approximately 85-98 percent of those estimated for Alternative I. Emissions from OCS offshore activities in the northwestern and northcentral Gulf represent 97 percent of the total emissions estimated; whereas, those estimated for offshore Florida represent approximately 3 percent. Selection of this alternative over the proposal would reduce total air emissions in the northwestern Gulf by 8 percent, in the northcentral Gulf by 10 percent and by 32 percent in the northeastern Gulf. Emissions will be greater in the northwestern and northcentral Gulf based on OCS development trends. Total emissions of the five primary pollutants from new wells, platforms, and vessels would range from 22,887 to 283,280 metric tons over the 45-year life of the proposal. New wells will contribute mostly NO_x; platforms mostly NO_x, CO, and VOC; and vessels will contribute all pollutants. During the early years of activity, emissions would be small and increase over time as production increases. After reaching a maximum, emissions will decrease rapidly to zero as the proposed scenario assumes all platforms will be removed and service vessels trips no longer needed.

Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. For spills greater than or equal to 1,000 bbl, emissions are of order 285 tons/hour or less. Concentrations reaching onshore areas from these spills would be on the same level as before based on the dispersion, limited input of pollutants to the atmosphere, and transport regime present. The emissions from the oil spills will last until all the volatile compounds are evaporated, and this takes about three days. About four percent of OCS crude-oil production is offloaded from surface vessels at ports off Texas and the northern coast of the Gulf. Off Florida, up to 25 percent of the OCS production would be offloaded from surface vessels. The unintentional emissions from offloading operations are unknown, but are estimated to be negligible (von Bodungen pers. commun., 1988) in the northern coast of the Gulf. Off Florida, all unintentional emissions from offloading crude would be negligible because estimated crude oil production in this area will be small.

CONCLUSION: Under Alternative III emissions of pollutants into the atmosphere from the assumed activities associated with this alternative are likely to have concentrations that would not change onshore air quality classifications because of the prevailing atmospheric conditions and emissions height. Onshore concentrations of air pollutants from the program-related emissions are estimated to be near $1ug/m^3$ (annual average) because the atmospheric regime, the emissions, and distance of these emissions from the coastline. The air quality status in the Gulf of Mexico is not expected to change.

(2) Alaska Region

Virtually all phases of activities—exploration, development, and production—have emissions with potential to change the concentration of pollutants in the ambient air. Emissions are the result of the burning of fuel in diesel engines or turbines for the generation of electricity.

Accidental emissions result from gas blowouts, evaporation of spilled oil, and burning of spilled oil. The scenario for Alternative III assumes for the Arctic Region one spill of 1,000 bbl or more from a pipeline; two tanker spills of 1,000 bbl or more are assumed along the shipping routes in the Bering Sea—two in the Gulf of Alaska and two along the coast of the western United States.

Estimates of emissions the could affect onshore ambient-air quality are based on fuel consumption from diesel engine and turbine generation of shipboard and platform electricity. Electricity consumption is based primarily on the number of exploration, delineation, and production wells and their depth, and the annual oil-production rate. This information is used to prepare an estimate of annual emissions of criteria pollutants for the peak year of exploration, development, and production phases for Alternative I. A similar analysis follows for Alternative III with a comparison of emissions of the two cases.

Relative to the proposal, Alternative III, slow-leasing pace, has fewer lease sales in the Beaufort and Chukchi Seas while those of the Bering and Gulf of Alaska remaining the same. The Table IV.D.3-8 identifies the amount, timing, and peak years for drilling, platform installation, and production for each planning area for Alternative III.

Table IV.D.3-8. Drilling, Platform Installation and Production for Peak Years

Planning Area	Exploration Wells No. (yrs)	Delineation Wells No.(yrs)	Platform No. (yrs)	Oil Production MMbbl (yrs)
Beaufort Sea	3 (1995)	18 (2000)	1 (1999)	25(2002-2006)
Chukchi Sea	8 (1996)	48 (2005)	2 (2002)	98(2006-2010)
Navarin Basin	3 (1998,1999)	14 (2003,2004)	1 (2001)	20 (2005-2009)
St. George Basin	3 (1997,1998)	14 (2003,2003)	1 (2000)	19 (2004-2008)
Cook Inlet	3 (1996)	14 (2000)	1 (1998)	13 (2002-2006)
Gulf of Alaska	4 (1997)	12 (2000)	1 (2000)	29 (2004-2008)

The scenario for the proposal assumed two platforms in the Beaufort, four platforms in the Chukchi, two platforms in the Bering, one in Cook Inlet, and one in the Gulf of Alaska. The highest estimated annual uncontrolled emission was calculated to be NO_x (exceeding 250 tons per year requiring emission-control measures). It was also assumed that NO_x emissions will be the largest uncontrolled pollutant (also exceeding 250 tons per year) for exploration, development, and production activities. Therefore, the analysis for this alternative examines potential NO_x and assumes all other emissions would be lower (probably significantly lower) than NO_x emissions. The analysis for the proposal projected an increase in NO_x concentrations to the ambient air as high as 0.91 ug/m^3 at the shoreline during exploration and 0.05 to 0.37 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations.

Peak emissions from Alternative III for exploration are estimated to be 33 percent (3 wells) to 80 percent (8 wells) of the total exploration emissions for the peak Sale 126 base case. Peak emissions from platforms are estimated to range from 10 (a single platform) to 75 percent (4 platforms in the Chukchi) of the total production emissions for the Sale 126 base case. Control measures available for NO_x emissions would result in reductions of 10 to 20 percent for diesel engines (used during exploration) and 70 to 80 percent for gas turbines (used during production). Application of BACT could result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.10 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations.

The timing of development is expected to be the same as for the proposal. Because of the low level of pollutants in the Alaskan onshore ambient air and continual diffusion of OCS emissions that reach the shoreline, changes in air quality due to OCS emissions will only occur during the time activities are being conducted. Air quality will quickly return to the state it would otherwise have been soon after (weeks to months) OCS activities cease. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions) starting in year 10. Production is expected to occur from years 12 to 30 after the lease sale, with the highest level of production occurring during the first year of development.

The NO_x emissions for diesel engines (during exploration) would result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.10 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions) starting in year 10.

Accidental emissions result from gas blowouts, evaporation of spilled oil, and burning of spilled oil. The scenario for Alternative III assumes for the Arctic Region one spill of 1,000 bbl or more from a pipeline; two tanker spills of 1,000 bbl or more are assumed along the shipping routes in the Bering Sea—one in the Gulf of Alaska, and two along the coast of the Western U.S.

Potential accidental emissions are discussed in the analysis for the proposal. Potential accidental emissions for Alternative III would be about the same as for the proposal. The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last a short period after emissions cease.

CONCLUSION: Under Alternative III, the NO_x emissions for diesel engines (during exploration) would result in NO_x increases to the ambient air of 0.30 to 0.73 microgram/meter^3 (ug/m^3) at the shoreline during exploration and 0.01 to 0.10 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last less than a week after emissions cease.

(3) Pacific Region

Alternative III, Slow the Pace of Leasing, changes the timing and number of sales identified in Alternative I. In the Pacific Region, there is no change in the proposed action from Alternative I. In the Alaska Region, the numbers of sales in the Beaufort and Chukchi Seas are each reduced from two to one. In addition, the remaining sale in the Chukchi Sea is delayed for 2 years, from 1994 to 1996.

As a consequence of Alternative III, one less tanker spill (due to Alaskan OCS production) is hypothesized to occur along the west coast of the United States than was estimated in Alternative I. Even with a reduction in the total number of potential tanker oil spills, estimated impacts to air quality are unchanged because the spill was assumed to occur offshore northern California, more than 80 km (50 miles) offshore.

Oil and gas exploration, development, and production activities are expected to result in emissions of NO_x and RHC which are precursors to ozone (O_3). The emissions from the seven proposed platforms for alternative I would be rather small compared to existing onshore emissions (see Table IV.D.1.a-14). If one compares total emissions of NO_x from the generic platforms (Table IV.D.1.a-11) with total existing onshore emissions for San Luis Obispo or Santa Barbara County the relative contribution from the platforms is less than one percent.

The effects of emissions associated with the seven platforms on acid deposition are expected to be negligible. This is based on the expected rate of emissions of NO_2 and SO_2. These emissions are only a small fraction of existing emissions of those pollutants in the southern California area.

Assuming the 7,000 bbl pipeline spill hypothesized for the southern California planning area occurs within one hour, total emissions during the first and second hour would be 399,000 lbs and 203,000 lbs respectively. An event such as this would have the potential to create air quality problems in the vicinity of the spill for the duration of the spill. However, onshore effects are highly dependent on the distance offshore, and weather conditions at the time. Spills greater than 3 miles from shore are unlikely to have long term, measurable effects on onshore air quality.

Alternative III would eliminate the tanker spill assumed to occur off the Northern California Planning area. However, the tanker spills from Alaskan OCS production are still assumed to occur off Washington and southern California. Total emissions for each spill during the first and second hour would be 1,710,000 lbs and 870,000 lbs respectively. In the event the spill occurs nearshore, impacts to the Washington and southern California areas could result in short-term exceedance of the onshore standard in the vicinity of the spill for the duration of the spill.

CONCLUSION: Adoption of Alternative III is not expected to result in an exceedance of the ambient air quality standards or Prevention of Significant Deterioration increments. Emissions of NO_x and RHC from platforms and vessels are estimated to be less than 5 percent of future projected onshore emissions. Because of the O_3 nonattainment status of all the onshore areas, the Clean Air Act would require emission offsets for all NO_x and RHC emissions from a facility. Any residual emissions from vessels would be small and would not be expected to contribute to a violation of the Federal or State ambient air quality standards for O_3.

Based on the assumed tanker spills for this alternative, local air quality standards off the Washington and southern California planning areas in the vicinity of the spill are expected to be temporarily exceeded. These exceedances are expected to last for the duration of a spill, but are not expected to result in long term effects to onshore air quality.

(4) Atlantic Region

The expected impacts on air quality resulting from routine OCS activities are described in Alternative I scenario (see Section IV.D.1.a(2)), where it was concluded that onshore air quality will be unaffected by routine OCS activities. Offshore air quality will be affected in the immediate vicinity of the emissions but only during the time period of the emissions. The causes of impacts on air quality due to routine OCS activities are described in Alternative I (Section IV.D.1.a(2)). Under the scenario for Alternative III, there will be no change in the causes of air quality impacts. Combustion of diesel fuel by support vessels and drillships, and the combustion of natural gas by turbines on OCS development/production platforms are the principal causes of routine emissions onshore and offshore. Potential air pollutants released during onshore and offshore OCS activities include VOC, NO_x, SO_x, CO, TSP, and H_2S.

A discussion of the potential impacts on air quality from routine emissions offshore is provided in the impact analysis for Alternative I (Section IV.D.1.a(2)). The impact of routine emissions on offshore air quality will be restricted to the immediate vicinity of the emissions. Pollutants will dissipate rapidly after emissions cease due to prevailing offshore winds. Under the scenario for Alternative III, there will be a net decrease in total offshore emissions compared to Alternative I as a consequence of the decrease in the level of OCS drilling operations by about one-third.

Onshore effects on air quality under the scenario for Alternative III are expected to be the same as the effects on air quality described for Alternative I (Section IV.D.1.a(2)). No changes will occur in the number of support bases, gas processing plants, and oil refineries. The principal impacts on onshore air quality will occur from gas processing plants and oil refineries. Potential air pollutants from these sources include VOC, TSP, and H_2S. The actual effect of these pollution emissions on air quality will be controlled by NAAQS standards, and State and local air quality regulations.

Impacts on air quality from small operational oil spills are described in Alternative I (Section IV.D.1.a(2)). Because small operational oil spills are expected to be fuel spills which dissipate rapidly, the duration of impacts on air quality will be no more than a few days, depending on the size and location of the spill. Oil spills greater than or equal to 1,000 bbl are not expected under this scenario.

The effects of routine OCS development in the mid- and south Atlantic under the scenario for Alternative III are unlikely to significantly effect air quality. Effects are expected to differ little from the effects on onshore and offshore air quality described in Alternative I. The greatest impacts on onshore air quality will result from accidental fuel oil spills.

CONCLUSION: Air pollution emissions from OCS gas and oil activities under the scenario for Alternative III will not measurably degrade air quality onshore or offshore. Some air quality parameters (such as NOx, SOx, CO, VOC, and TSP) are expected to be locally elevated one or two orders of magnitude for a few days or less during offshore or onshore emissions.

c. Impacts on Marine Mammals

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect endangered and threatened cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to endangered and threatened cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb endangered and threatened cetaceans because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. The effects on endangered and threatened cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on endangered and threatened cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on endangered and threatened cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect endangered and threatened cetaceans. Three oil spills (greater than or equal to 1,000 bbl) would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. The effect on endangered and threatened cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation. (A generation is defined as the term of years accepted as the average period between the birth of the parents and the birth of their offspring.)

CONCLUSION: As a result of this alternative, there will be no discernible decline in an endangered or threatened cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil, and the probability of their occurrence (10,000 bbl) ranges up to 18 percent.

(b) Nonendangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb cetaceans because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. The effects on cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect non-endangered and non-threatened cetaceans. Three oil spills (greater than or equal to 1,000 bbl) would occur from program-related activities and increased tanker imports due to decreased domestic production. The two (30,000 bbl) import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import tanker spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One oil spill (25,000 bbl pipeline spill) is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. The effect on cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths affected by spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges up to 18 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Alaska Region

(a) Threatened or Endangered Species

1) Cetaceans

a) Bowhead Whale

Effects on bowhead whales associated with Alternative III could result from routine activities including vessel movements, seismic surveys, dredging, drilling, drillships, pipeline construction, and production operations. All of these activities produce industrial noise that may elicit a response from whales. The effects of these activities on migrating bowheads have been described previously for Alternative I. When these activities occur within 1 to 4 km of whales, most would probably change their swimming direction to avoid them. No change in the overall fall migration route is expected due to this alternative.

Because Alternative III is the same as the proposal in all areas except for the Beaufort and Chukchi Seas, the expected effect of this alternative on endangered whales in other areas would be the same as Alternative I. However, Alternative III involves fewer lease sales in each planning area. This would effectively reduce the expected amount of industrial noise and the number of probable oil spills encountered by bowhead whales in the Chukchi and Beaufort Seas.

Alternative I assumes the drilling of 397 wells and placement of 10 platforms in the Chukchi and Beaufort Seas. Alternative III assumes the drilling of 230 wells and the placement of six platforms in these areas. Hence, under Alternative III, the number of probable whale/industrial noise encounters would be about 40 percent less per year than under Alternative I. Based on the assumptions discussed for Alternative I, and assuming further that drilling and platform operations occur when whales are migrating through the area, noise associated with Alternative III is estimated to cause from up to 24 percent per year of the bowhead population to swim around sources of industrial noise. However, due to their dispersed condition during the fall migration, bowhead whales are expected to encounter little industrial noise in the Chukchi Sea in the fall. Also, based on past operations in the Chukchi Sea, exploratory drilling in the spring is expected to take place after bowheads have already passed through the area. Hence, few bowhead/industrial noise encounters are expected in the Chukchi Sea, unless production facilities are placed in the nearshore area. Effects associated with Alternative III also could result in bowhead whales encountering an oil spill (equal to or greater than 1,000 bbl). The scenario for Alternative III assumes that there would be no oil spills in the Beaufort Sea and one in the Chukchi Sea. Because the scenario for Alternative I assumed one pipeline spill for the Beaufort Sea and two pipeline and one platform spills for the Chukchi Sea, Alternative III would eliminate any oil-spill effect in the Beaufort Sea and would reduce The potential for oil spill effects in the Chukchi Sea by about 60 percent. If an oil spill occurred and contacted bowhead whales, effects may include those discussed for Alternative I including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency for up to a couple of days, and skin and/or sensory-organ damage. Based on the assumptions discussed for Alternative I, and assuming further that the estimated number of pipeline and tanker spills for Alternative III occurred during annual migrations, it is estimated that they would affect from up to 8 percent of the bowhead whale population.

CONCLUSION: Based on the assumptions for Alternative III, sublethal effects on up to 24 percent per year of the bowhead population due to noise and up to 8 percent of the population due to oil spills are expected. These effects are more likely to occur in the Beaufort Sea rather than the Chukchi Sea. None of the above sublethal effects on bowhead whales are expected to affect recruitment or distribution of the species. There is an 11 to 38 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the bowhead whale over the 30-year life of the proposal.

b) Fin and Humpback Whales

Because the scenario for Alternative III is the same as Alternative I in areas within the range of fin and humpback whales, effects on these species as the result of the adoption of Alternative III would be as discussed for Alternative I.

CONCLUSION: Noise associated with Alternative III is expected to have sublethal effects on up to 20 percent of fin and humpback whale populations each year. Tanker oil spills are expected to have sublethal effects on up to 10 percent of these species' populations over the life of Alternative III. None of the above sublethal effects are expected to affect recruitment or distribution of these species.

c) Right, Blue, Sei, and Sperm Whales

Because the scenario for Alternative III is the same as Alternative I in areas within the range of right, blue, sei, and sperm whales, effects on these species as the result of the adoption of Alternative III would be as discussed for Alternative I.

CONCLUSION: Noise associated with Alternative III is expected to have sublethal effects on up to 10 percent of right, blue, sei, and sperm whale populations each year. Tanker oil spills are expected to have sublethal affects on up to 5 percent of these species' populations over the life of Alternative III. None of the above sublethal effects are expected to affect recruitment or distribution of these species.

2) Pinnipeds

STELLER SEA LION: Oil spills, and subsequent containment and cleanup operations, are the only source of adverse impact on the Steller sea lion pertinent to this alternative. The alternative differs from the proposal (Alternative I) in assuming that one less oil spill originating from a tanker serving the TAP will occur along the coast of northern California.

Reduction in oil-spill impact on sea lions south of Alaska is expected to reduce overall impact on the North Pacific population somewhat from the proposal, requiring three generations or less for recovery. The principal effect would be to decrease local impacts since only a small proportion of the population make up the North Pacific population and because reproduction occurs at the southern extremes of this species range.

CONCLUSION: Overall impacts on the sea lion population resulting from reduction of potential tanker spills under Alternative III is expected to be somewhat less than the proposal (Alternative I), requiring three generations or fewer for recovery to the original population status from oil contacting 20 to 50 percent of local concentrations and pup mortality probably involving fewer than 200 individuals. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the Steller sea lion over the 30-year life of the proposal.

(b) Nonendangered Species

1) Cetaceans

a) Beluga Whale

Alternative III would involve fewer oil spills (see Table IV.D.3-4) assumed to occur and potentially affect beluga whales by 75 percent (from 4 under the proposal to 1 under Alternative III) in the Beaufort Sea and Chukchi Sea Planning Areas. The number of small spills assumed to occur in the Arctic also is fewer (from 647 spills of 1-50 bbl under the proposal to 373 spills under this alternative and 26 spills of 51-999 bbl under the proposal to 15 spills under this alternative). This alternative has a 75 percent lower potential for exposing beluga whales to spilled oil. The number of platforms in the Beaufort and Chukchi Sea Planning Areas is 6 for this alternative, which is 4 fewer than the proposal. This would mean less icebreaker activity (about 20 vessels under Alternative I to 12 for this alternative) and less (perhaps by one third) noise and disturbance of beluga whales in the Arctic. Under Alternative III, oil and gas exploration and development activities assumed in the Bering Sea and Gulf of Alaska are the same as assumed under the proposal; thus, effects on beluga whales in the Bering Sea and Gulf of Alaska are expected to be the same as under the proposal.

Under Alternative III, primary effects on beluga whales are expected to come from noise and disturbance, especially icebreaking activities, and other marine-vessel traffic and oil spills. Noise and disturbance from icebreakers and other marine traffic are expected to temporarily (a few days to less than 3 years) displace or interfere with beluga whale movements within a few to several miles of the activities. Few beluga whales are likely to die from contact with oil spills. The loss of beluga whales from the one assumed oil spill (perhaps 25 whales or less) in the Alaskan populations is expected to be less than the losses due to natural mortality such as losses from disease, predation, and subsistence harvest.

CONCLUSION: Fewer than 25 beluga whales are expected to be lost in the Arctic Subregion (Beaufort and Chukchi Seas) from exposure to the oil spills assumed for Alternative III. This is 75 percent fewer than estimated for the proposal. Noise and disturbance effects in the Arctic are expected to be less severe (by about one third) than those described for the proposal. There is an 18 to 76 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal in the Alaska Region.

b) Minke Whale

The activity in the Alaska Region assumed to occur under Alternative III will result in 4 less platforms (from 3 to 2 in the Beaufort Sea, and 7 to 4 in the Chukchi Sea) and accompanying decreases in associated activities. Potential impacts to minke whales from routine activities under Alternative III in the Alaska Region are likely to decrease somewhat from those discussed for Alternative I. These activities include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Section IV.D.1.a(3) provides a discussion of potential impacts on the minke whale population and an analysis of the impacts expected as a result of Alternative I.

As in Alternative I, effects on minke whales from routine activities are expected to be sublethal and temporary in nature, including primarily avoidance reactions and changes in direction at distances up to 5 km from the source. Due to greater levels of construction activities and the construction of four pipelines to the shoreline in the Alaska Region, it is expected that minke whales will be displaced from a few square kilometers of foraging area for one season or less.

The oil spill assumptions for the Pacific Region do not change from Alternative I under this alternative. In the Alaska Region, the number of oil spills assumed to occur under this alternative declines from the 12 assumed for Alternative I to 8: one pipeline spill (25,000 bbl) in the Chukchi Sea; two tanker spills (30,000 bbl per spill) in the Gulf of Alaska; one tanker spill each in the St. George Basin, Navarin Basin, and Cook Inlet Planning Area in the Alaska Region; and one tanker spill each off the coast of Washington and in the Southern California Planning Area in the Pacific Region. As in Alternative I (see Section IV.D.1.a(3)), it is expected that the oil spills assumed to occur under Alternative III will cause no minke whale mortality and will not disrupt migratory movements through the Alaska and Pacific Regions.

CONCLUSION: Alternative III is expected to result in sublethal effects on minke whales lasting no more than a few months. No discernible changes in minke whale abundance or distribution are expected.

2) Pinnipeds

a) Northern Fur Seal

Oil spills are the only source of adverse impact on northern fur seals pertinent to this alternative. The alternative differs from the proposal (Alternative I) in assuming that one less oil spill originating from a tanker serving the TAP will occur along the coast of northern California.

During the period December to May, most northern fur seals are dispersed in offshore waters of the North Pacific. At the low densities encountered, relatively few are vulnerable to oil-spill contact and losses are expected to be few and require considerably less than a generation (4 to 6 years) for recovery. As a result, this alternative is expected to differ minimally from the proposal, requiring three or more generations for recovery to the original population status, depending on the seasons and areas of impact. However, if a reduction in tanker spills results in fewer spills in southern California during the breeding season, local impact on the San Miguel Island rookery is expected to be reduced substantially.

CONCLUSIONS: Overall impact from disturbance and oil spills on the northern fur seal population resulting from reduction of potential tanker spills under Alternative III is expected to be similar to the proposal (Alternative I), requiring up to three or more generations (12 plus years) for recovery from mortality exceeding 5,000 seals to the original population status. The potential exists for substantially lower local impact on the San Miguel Island rookery. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the northern fur seal over the 30-year life of the proposal.

b) Ice Seals

Aircraft- and vessel-support operations and construction and/or operation of offshore and onshore industrial facilities are the principal routine sources of disturbance of ice seals that are expected to decrease by reducing the number of platforms from three to two and seven to four in the Beaufort and Chukchi Seas, respectively, with this alternative. The estimated number of oil spills, and subsequent cleanup operations, is one in the Beaufort and Chukchi Seas, respectively. Assumed oil spills in the Bering Sea remain at two.

Fewer platforms in the Beaufort and Chukchi Seas for Alternative III than for Alternative I would reduce somewhat the area between these sites and shore bases over which aircraft would disturb ice seals as well as the total area surrounding industrial sites that essentially is rendered unavailable for seal activities. However, activities disturbing to seals still may occur in the vicinity of seal-concentration areas (e.g., leads, new ice, coastal haulouts), thereby diminishing the overall reduction in disturbance occurring elsewhere. Disturbance of seals in the Bering Sea is expected to remain unchanged from the proposal. Overall disturbance losses resulting from this alternative are expected to be somewhat reduced from the proposal (Alternative I), requiring less than one generation for recovery to the original population status.

Under this alternative, impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea, the single estimated oil spill remaining is expected to contact some ringed and bearded seal pups and adults if occurring in spring and adults and subadults/juveniles in other seasons; adult and subadult/juvenile spotted and ribbon seals could be contacted by a spill in summer. Because of their generally low density and the probable lack of adult lethal sensitivity to oil, none of these populations are expected to sustain losses greater than several hundred individuals. Losses of seals from oil spill contact in the Bering Sea are expected to remain unchanged from the proposal. Impacts of oil-spill-cleanup operations are expected to decline in proportion to the reduction in oil spills. Overall impacts caused by oil spills are expected to be reduced somewhat from the proposal, requiring less than one generation for recovery.

Fewer platforms under this alternative are expected to reduce somewhat the area over which aircraft would disturb ice seals as well as the total area surrounding industrial sites that essentially is rendered unavailable for seal activities; losses from disturbance are expected to require less than the equivalent of a generation for recovery to the original population status. Impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea, the remaining oil spill is expected to contact up to several hundred ice seals and require less than one generation for recovery. Impacts on ice seals in the Bering Sea are expected to remain unchanged from the proposal.

CONCLUSION: Overall impact of Alternative III from disturbance and oil spills on ice seals (few hundred individuals) is expected to be somewhat less, as a result of fewer sales in Beaufort and Chukchi Planning Areas, than the proposal (Alternative I), requiring less than one generation (4 to 7 years) for recovery to the original population status. There is a 17 to 38 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the ice seal over the 30-year life of the proposal.

c) Harbor Seal

Oil spills, and subsequent containment and cleanup operations, are the only source of adverse impact on the harbor seal pertinent to this alternative. The alternative differs from the proposal (Alternative I) in assuming that one less oil spill originating from a tanker serving the TAP will occur along the coast of northern California.

Fewer oil-spill impacts on harbor seals south of Alaska are expected to cause somewhat less overall impact on the North Pacific population from the proposal, requiring less than one generation (4 to 6 years) for recovery. The Pacific regional population, because of its relatively small size, is expected to derive more benefit from the reduction of a tanker spill but also would require less than one generation for recovery to its original status.

CONCLUSIONS: Overall impacts on the harbor seal population probably involving mortality of fewer than 200 pups, resulting from reduction of potential tanker spills under Alternative III are expected to be somewhat less than for the proposal (Alternative I), requiring less than one generation (4 to 6 years) for recovery to the original population status. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the harbor seal over the 30-year life of the proposal.

d) Pacific Walrus

Aircraft- and vessel- (especially icebreaker) support operations and construction and/or operation of offshore and onshore industrial facilities are the principal routine sources of disturbance of walruses that are expected to decrease by reducing the number of platforms from three to two and seven to four in the Beaufort and Chukchi Seas, respectively, with this alternative. The estimated number of oil spills, and subsequent cleanup operations, is one in the Chukchi Sea. Assumed oil spills in the Bering Sea remain at two.

Fewer platforms are expected to reduce somewhat the area between these sites and shore bases over which aircraft could disturb walruses as well as the total area surrounding industrial sites that essentially is rendered unavailable for walrus use by icebreaker and other activities. However, activities disturbing to walruses (potentially lethal to calves) still may occur, particularly in the vicinity of female-calf nursery herds during spring migration or in summer, thereby diminishing the overall reduction in disturbance occurring elsewhere. Disturbance of walruses in the Bering Sea is expected to remain unchanged from the proposal. Overall disturbance losses resulting from this alternative are expected to be somewhat reduced from the proposal (Alternative I), requiring less than one generation for recovery to the original population status.

Under this alternative, impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea area, the single estimated oil spill remaining is expected to contact some walrus calves and females if occurring in the summer season. Because relatively small numbers of walruses are expected to be contacted by an oil spill and the probable lack of at least adult sensitivity to oil, the population is not expected to sustain losses greater than several hundred individuals. Impacts of oil-spill-cleanup operations are expected to decline in proportion to the reduction in oil spills. Loss of walruses from oil contact in the Bering Sea is expected to remain unchanged from the proposal. Overall impacts caused by an oil spill are expected to be somewhat less than the proposal, requiring less than one generation for recovery.

Fewer platforms under this alternative would reduce somewhat the area over which aircraft could disturb walruses as well as the total area surrounding industrial sites that essentially is rendered unavailable for walrus activities; losses from disturbance are expected to require less than the equivalent of a generation for recovery to the original population status. Impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea, the remaining oil spill is expected to contact up to several hundred walruses and require less than one generation for recovery. Impacts on walruses in the Bering Sea are expected to remain unchanged from the proposal.

CONCLUSION: Overall impacts of Alternative III from disturbance and oil spills on the Pacific walrus, probably involving mortality no greater than 200 individuals, are expected to be somewhat less, as a result of fewer sales in the Beaufort and Chukchi Planning Areas, than for the proposal (Alternative I), requiring less than one generation (10 years) for recovery to the original population status. The probability of one or more spills of 10,000 bbl or greater occurring ranges from 21 to 38 percent through the range of the Pacific walrus over the 35-year life of the proposal.

3) Sea Otter (Alaska Population)

Oil spills, and subsequent containment and cleanup operations, are the only source of adverse impact on the sea otter pertinent to this alternative. The alternative differs from the proposal (Alternative I) in assuming that one less oil spill originating from a tanker serving the TAP will occur along the coast of northern California.

Fewer oil-spill impacts on sea otters south of Alaska would not reduce the impact on the Alaska population; thus, the impacts from this alternative remain the same as the proposal, requiring two generations or more for recovery of the population to its original status.

CONCLUSION: Overall impacts on the Alaska sea otter population resulting from this alternative, potential mortality of up to 500 individuals, are expected to be the same as the proposal (Alternative I), requiring two generations (6 to 10 years) or more for recovery to the original population status. There is an 18 to 34 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the sea otter over the 30-year life of the proposal.

4) Polar Bear

Aircraft- and vessel-support operations and construction and/or operation of offshore and onshore industrial facilities are the principal routine sources of polar bear disturbance that are expected to decrease , because there is one less platform in the Beaufort Sea and three fewer platforms in the Chukchi Sea with this alternative. The estimated number of oil spills, and subsequent cleanup operations, is reduced from one to zero and three to one in the Beaufort and Chukchi Seas, respectively.

Fewer platforms are expected to reduce somewhat the area between these sites and shore bases over which aircraft could disturb bears, as well as the total area surrounding industrial sites that essentially is rendered unavailable for bear activities. However, activities disturbing to bears still may occur in the vicinity of bear concentration or denning areas. Overall disturbance losses resulting from this alternative are expected to be somewhat less than the proposal (Alternative I), requiring less than one generation for recovery to the original population status.

Under this alternative, impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea area, the one assumed oil spill is not expected to contact bear concentrations although the potential still exists for the spill to be transported into northern Chukchi areas where the probability of contacting females with cubs (moving away from Wrangel Island) is higher than elsewhere. Overall impacts caused by an oil spill are expected to be substantially less than from the proposal, requiring less than one generation for recovery.

CONCLUSION: Overall impacts to polar bears resulting from Alternative III (mortality of up to 25 individuals) are expected to be somewhat less, as a result of fewer sales in Beaufort and Chukchi Planning Areas, than for the proposal (Alternative I), requiring less than one generation (5 to 8 years) for recovery to the original population status. Impacts caused by an oil spill are expected to be reduced substantially from the proposal, requiring less than one generation for recovery. There is an 21 to 38 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the polar bear over the 30-year life of the proposal.

(3) Pacific Region

(a) Threatened or Endangered Species

1) Cetaceans

GRAY WHALE: The reduction in activity in the Alaska Region assumed to occur under Alternative III will result in 4 less platforms (from 3 to 2 in the Beaufort Sea, and 7 to 4 in the Chukchi Sea) and accompanying decreases in associated activities. Potential impacts to gray whales from routine activities under Alternative III in the Alaska Region are likely to decrease somewhat from those discussed for Alternative I. These activities include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Section IV.D.1.a(3) provides a discussion of potential impacts on the gray whale population and an analysis of the impacts expected as a result of Alternative I.

As in Alternative I, effects on gray whales from routine activities are expected to be sublethal and temporary in nature, including primarily avoidance reactions and changes in direction at distances up to 5 km from the source. No disruption of gray whale migration through the Alaska and Pacific Regions is expected. In the species' Bering and Chukchi Sea feeding grounds, gray whales may be displaced from areas of a few tens of square kilometers for one season or less during platform and pipeline construction. Some whales may also be excluded from feeding within a few hundred meters of drilling units and production platforms.

The oil spill assumptions for the Pacific Region do not change from Alternative I under this alternative. In the Alaska Region, the number of oil spills assumed to occur under this alternative declines from the 12 assumed for Alternative I to 8: one pipeline spill (25,000 bbl) in the Chukchi Sea; two tanker spills (30,000 bbl per spill) in the Gulf of Alaska; one tanker spill each in the St. George Basin, Navarin Basin, and Cook Inlet Planning Area in the Alaska Region; and one tanker spill each off the coast of Washington and in the Southern California Planning Area in the Pacific Region.

As in Alternative I, it is expected that the oil spills assumed to occur along the species' migratory pathway through the Alaska and Pacific Regions will result in no mortality and will not disrupt the gray whale migration.

An oil spill is assumed to occur in the primary gray whale summer feeding grounds in the northern Bering and Chukchi Seas. As in Alternative I, the occurrence and contact of one such spill during the summer could result in the death of a few individuals and the displacement of animals from an area of up to 1,500 km^2 for all or part of a season.

CONCLUSION: The adoption of Alternative III is expected to result primarily in sublethal effects on the gray whale population involving changes in abundance and distribution lasting a year or less. A few deaths are expected to occur due to oil spills. This level of mortality is not expected to be distinguishable from natural variability within the gray whale population. There is up to a 62 percent probability of one or more spills of 10,000 bbl or greater occurring in the Pacific or Alaska Regions over the 35-year life of the proposal.

2) Pinnipeds

GUADALUPE FUR SEAL: The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to the Guadalupe fur seal would remain the same. Section IV.D.1 provides a discussion of potential impacts to the Guadalupe fur seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on Guadalupe fur seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the Guadalupe fur seal population.

Two oil spills of 1,000 bbl or more are assumed to occur off southern California under this alternative. Since a small, undetermined number of Guadalupe fur seals are probably present in these waters at any one time, it is possible that such a spill would contact and kill a few individual fur seals. This level of mortality would not be distinguishable from natural variability within the population.

CONCLUSION: Adoption of Alternative III is expected to have no discernible effect on Guadalupe fur seal abundance and distribution.

3) Sea Otter (Pacific Population)

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to the California and Washington sea otter populations would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the sea otter populations in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea otters include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Routine operations associated with the proposed action are not expected to impact the California or Washington sea otter populations.

Three oil spills of 1,000 bbl or greater are assumed to occur in the Pacific Region under this alternative: one off the coast of Washington, and two off southern California. An oil spill contacting the sea otter populations in either of these areas would result in mortality and temporary loss of habitat. Assuming a pipeline spill and contact to the California mainland range, up to 13 percent of the population could die, and recovery of the California sea otter population would take up to 3 years. Assuming a spill and contact to San Nicolas Island, the translocated sea otter population would probably be eliminated. Assuming a spill and contact to the Washington range, tens of otters would die, and recovery of the Washington sea otter population would possibly take more than 5 years.

CONCLUSION: Adoption of Alternative III is expected to have lethal effects on sea otter populations in the Pacific Region. Sea otter mortality is expected to occur as the result of accidental oil spills; population recoveries will take 4 to 5 years or more. There is an up to 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(b) Nonendangered Species

1) Cetaceans

a) Killer Whale

The reduction in activity in the Alaska Region assumed to occur under Alternative III will result in 4 less platforms (from 3 to 2 in the Beaufort Sea, and 7 to 4 in the Chukchi Sea) and accompanying decreases in associated routine activities. The number of oil spills assumed to occur under this alternative declines from the 12 assumed for Alternative I to 8: one pipeline spill (25,000 bbl) in the Chukchi Sea; two tanker spills (30,000 bbl per spill) in the Gulf of Alaska; one tanker spill each in the St. George Basin, Navarin Basin, and Cook Inlet Planning Area in the Alaska Region; and one tanker spill each off the coast of Washington and in the Southern California Planning Area in the Pacific Region. South of the Chukchi Sea, one less spill is assumed to occur than in Alternative I.

The overall impacts to the killer whale population from normal activities and accidental events under Alternative III are not likely to differ substantially from Alternative I. Section IV.D.1.a(3) provides a discussion of potential impacts on the killer whale population and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on killer whales include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no measurable effects on the killer whale population.

In the Pacific Region, no mortality is expected as a result of oil spills; changes in killer whale numbers and distribution in areas contacted by a spill are expected to last less than 1 year. In the Alaska Region, oil spills are expected to result in the death of a few killer whales in protected waters. This level of mortality is expected to be indistinguishable from natural variability in the killer whale population.

CONCLUSION: Adoption of Alternative III is expected to result in minor killer whale mortality involving a few individuals. This level of mortality is expected to be indistinguishable from natural variability in the killer whale population. Accidental oil spills in the Alaska Region are the primary impacting factor. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal in the Alaska Region.

b) Harbor Porpoise

The activity in the Alaska Region assumed to occur under Alternative III will result in 4 less platforms (from 3 to 2 in the Beaufort Sea, and 7 to 4 in the Chukchi Sea) and accompanying decreases in associated routine activities. The number of oil spills assumed to occur under this alternative declines from the 12 assumed for the base case to 8: one pipeline spill (25,000 bbl) in the Chukchi Sea; two tanker spills (30,000 bbl per spill) in the Gulf of Alaska; one tanker spill each in the St. George Basin, Navarin Basin, and Cook Inlet Planning Areas in the Alaska Region; and one tanker spill each off the coast of Washington and in the Southern California Planning Area in the Pacific Region. South of the Chukchi Sea, one less spill is assumed to occur than in the proposal.

Since harbor porpoises are uncommon north of Bristol Bay in the eastern Bering and are seldom observed in the Chukchi and Beaufort Seas (Leatherwood et al., 1982; Green et al., 1989), the overall impacts to the harbor porpoise population from normal activities and accidental events under Alternative III are not likely to differ substantially from Alternative I. Section IV.D.1 provides a discussion of potential impacts on the harbor porpoise population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on harbor porpoises include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Pipeline construction activities are expected to result in the displacement of harbor porpoises from a few square kilometers of nearshore habitat in Cook Inlet and the Gulf of Alaska for a period of several months.

It is likely that part of the harbor porpoise population in the Gulf of Alaska or Washington will be exposed to at least one of the oil spills assumed to occur under this alternative. Assuming occurrence and contact, oil spills are expected to result in the loss of a few harbor porpoises and the possible displacement of animals from the area of the spill for several months.

CONCLUSION: Adoption of Alternative III is expected to result primarily in sublethal effects on harbor porpoises lasting less than 1 year. A few mortalities are expected to result from oil spills. No discernible changes in the species' abundance or distribution are expected. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

2) Pinnipeds

a) Northern Elephant Seal

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to the northern elephant seal would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the northern elephant seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on elephant seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the northern elephant seal population.

If one of the two oil spills assumed to occur off southern California under this alternative were to contact the rookery beaches on San Miguel or San Nicolas Island during the species' winter breeding season, some pup mortality could occur. Assuming occurrence and contact, oil spills are expected to result in the death of a few (less than 20) elephant seal pups. This level of mortality would not be distinguishable from natural variability within the elephant seal population.

CONCLUSION: Adoption of Alternative III is expected to result primarily in sublethal effects on the northern elephant seal population. A few mortalities (less than 20) are expected to occur due to accidental oil spills. No discernible changes are expected to occur in northern elephant seal abundance or distribution. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal.

b) California Sea Lion

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to California sea lions would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts on the California sea lion population and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on California sea lions include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact the California sea lion population.

Two spills are assumed to occur off southern California under this alternative. An oil spill contacting a California sea lion rookery during the species' summer breeding season would result in pup mortality. Assuming a spill during the summer and contact to one of the rookeries, it is possible that tens to hundreds of sea lion pups would die. Recovery of the California sea lion population from such a loss is expected to take 3 years or less.

CONCLUSION: Adoption of Alternative III is expected to result primarily in sublethal effects on the California sea lion population. Some mortality (of tens to hundreds of pups) is expected to occur due to oil spills. Population recovery will take no more than 3 years. No discernible changes in California sea lion distribution will occur. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal.

(4) Atlantic Region

(a) Threatened or Endangered Species

1) Cetaceans

Under Alternative III special protections would be in place for the protection of threatened and endangered cetaceans. Should concerns develop with respect to proposed operations, the Regional Director may require the lesser to undertake assessments of the extent of the resource affected, and the degree of the impact which may be expected. The findings of these actions may result in modification of Alternative III activities.

Under Alternative III, only 1 lease sale would occur during the period 1992 to 1997. The mean conditional resource estimate under Alternative III is 40 MMbbl as compared to 77 MMbbl under Alternative I. Under the slow leasing scenario, 25 exploration and delineation wells are drilled and development and production wells number 79. These figures are down 10 and 29 wells, respectively, from Alternative I scenario. Other than the reduction in the number of platforms to 4, the infrastructure requirements of Alternative III are the same as for Alternative I.

Potential impacts on endangered whales from routine OCS gas and oil activities include underwater noise (e.g., drilling, vessel and aircraft traffic, and geophysical surveys), collisions or startle reactions caused by ships, the presence of platforms or other structures, muds and cuttings discharges, and pipeline construction. With the exception of collisions between whales and vessels, the anticipated impacts on affected individual whales are sublethal.

The lower amount of offshore activity is expected to result in lower impacts to endangered cetaceans compared to those anticipated for Alternative I. Noise levels will be reduced due to the lower number of platforms and drilling activity. The 4 platforms will also require fewer vessel and aircraft trips. The reduced level of drilling is expected to result in lower quantities of muds and cuttings being discharged. Pipeline construction activity is not assumed to differ from Alternative I. However, as described in Alternative I (see Section IV.D.1.a(3)), the construction of the pipeline result in a short-term disturbance. Therefore, activities under Alternative III are not expected to measurably affect endangered cetacean species' populations on the Atlantic OCS.

Accidental oil spills and discharges are also fewer in number in comparison with Alternative I (see Section IV.D.1.a(3)). Chronic operational spills (>1 to 50 bbl) are reduced to 10. These spills are quickly dispersed by evaporation, wind, and wave action and are not expected to measurably impact any endangered cetacean population. One small spill (> 50 and <1,000 bbl) is assumed. Individual whales which might contact spilled oil could experience short-term and sublethal impacts in the form of tissue irritation (see Sections IV.A and IV.D.1.a(3)). As described in Alternative I, endangered cetaceans are relatively invulnerable to impacts from spilled oil. It is not expected that the single small spill assumed for Alternative III would measurably affect any endangered cetacean population on the Atlantic OCS. Oil spill greater than or equal to 1,000 bbl are not assumed under this alternative.

Even in the absence of special protections, no measurable impacts on endangered and threatened cetacean species are expected to occur.

CONCLUSION: No measurable changes in the population size, distribution, or behavior of endangered and threatened cetaceans are expected under Alternative III.

2) Sirenians

Special protections for manatees would be in effect under Alternative III. Should specific concerns be identified, the Regional Director may require the lessee to undertake actions to determine the extent of the resource being affected and to what degree. The outcome may result in the modification of the activities under Alternative III.

For a description of the routine activities and anticipated routine operational sources of potential impacts, see the previous description for endangered cetaceans and Sections IV.A, and IV.D.1.a(3).

The number and types of accidents assumed for Alternative III are also described under the discussion of endangered cetaceans. No spills of 1,000 bbl or more are assumed under this alternative.

The distribution of the West Indian Manatee and the offshore location of drilling and producing activities make it very unlikely that this species will be affected by any offshore activities. The siting of supply bases and supporting vessel and aircraft traffic may result in some individual contacts with the occasional migratory animal. Impacts which might arise from such contacts are expected to be sublethal (see Section IV.D.1.a(3)), except in the unlikely instance of a collision between a manatee and a supply vessel. The potential for such collisions under Alternative III would be negligible.

Even in the absence of special protections, no measurable impacts to endangered manatees are expected to occur.

CONCLUSION: No measurable changes in the population size, distribution, or behavior of the West Indian manatee are expected under Alternative III.

(b) Nonendangered Species

CETACEANS: As discussed for the endangered cetaceans, special protections for nonendangered and nonthreatened cetaceans would be in effect under Alternative III.

For a description of the routine activities and the identification of the anticipated routine potential impacts, see Section IV.D.1.a(3). The number and types of accidents assumed for Alternative III are also described in Section IV.D.1.a(3). No spills of 1,000 bbl or greater are assumed to occur.

The potential impact-producing factors due to routine OCS gas and oil activities which could affect nonendangered and nonthreatened cetaceans under Alternative III are essentially non-lethal and would occur at a level of intensity less than that assumed for Alternative I (see Section IV.D.1.a(3)). Potential impacts include possible site-specific avoidance of platforms due to noises from drilling, vessel and aircraft maneuvering, and other activities. Short-term avoidance behavior caused by geophysical surveys, vessel and aircraft traffic or other sources of noise are expected to occur. Muds and cuttings discharges are non-toxic and diffuse rapidly in the offshore environment. These discharges are not expected to measurably affect nonendangered and nonthreatened cetacean populations. Pipeline construction is a short-term activity relative to the estimated 30 year duration of the Alternative III and is not expected to measurably affect the nonendangered and nonthreatened cetacean populations on the Atlantic OCS.

Accidental impacts under the Alternative III involve the discharge of oil or other hydrocarbons. Over the estimated 30-year timeframe of this alternative, 10 chronic operational discharges (>1 to 50 bbl) are assumed. Also a single small spill (<50 and < 1,000 bbl) is assumed. As in Alternative I, no oil spill of 1,000 bbl or more is assumed. Chronic operational spills are quickly dispersed by evaporation, wind, and wave action and are not expected to discernibly impact nonendangered and nonthreatened cetacean populations. Individual whales and dolphins contacting spilled oil could undergo short-term and sublethal impacts in the form of soft tissue and skin irritation (see Sections IV.A and IV.D.1.a(3)). However, cetaceans in general are considered to be relatively invulnerable to impacts from spilled oil and the impacts of a single small spill at the population level for these species would be negligible.

Even in the absence of special protections, no measurable impacts to nonendangered and nonthreatened cetaceans are expected to occur.

CONCLUSION: No measurable changes in the population size, distribution, or behavior of nonendangered and nonthreatened cetaceans are expected under Alternative III.

d. Impacts on Terrestrial Mammals

(1) Gulf of Mexico Region

ALABAMA, CHOCTAWHATCHEE, AND PERDIDO KEY BEACH MICE: Accidental events such as oil spills and oil spill response activities may adversely affect Alabama, Choctawhatchee, and Perdido Key beach mice. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Less than five small spills from OCS activities will contact the Gulf coastline. It is expected that oil spills of any size class resulting from the proposal will not contact or affect Alabama, Choctawhatchee, and Perdido Key beach mice or their habitat due to their limited home range.

CONCLUSION: As a result of this alternative, no adverse effects to Alabama, Choctawhatchee, and Perdido Key beach mice are expected to occur.

(2) Alaska Region

CARIBOU: Aircraft and vehicle traffic and construction, operation, and maintenance of onshore industrial facilities are the principal sources of caribou disturbance that are expected to be less under Alternative III because there is one less platform in the Beaufort Sea and three fewer in the Chukchi Sea under Alternative III. While foraging, caribou may contact or ingest oil or inhale vaporizing oil stranded on beaches or released from onshore pipelines. Spill-cleanup operations are expected to cause caribou to temporarily abandon the affected areas. The estimated number of oil spills, and subsequent cleanup operations, is reduced from one to zero and three to one in the Beaufort and Chukchi Seas, respectively.

Because there are fewer platforms, the level of disturbing activity associated with onshore facilities (e.g., helicopter traffic) is expected to be somewhat less, but these declines will result in a minimal decrease in effects from the proposal (Alternative I). Thus, overall impact on arctic caribou is expected to require no more than two generations for recovery to the original population status. Under this alternative, any minor impacts resulting from oil spills are eliminated from the Beaufort Sea. Because of the small numbers of caribou likely to be contacted by stranded oil in the Chukchi Sea, any decrease in impact is expected to be minimal.

CONCLUSION: Based on the scenario for Alternative III, overall disturbance and oil-spill impacts on the arctic caribou population (fewer than 100 killed) are expected to be slightly less than for the proposal, requiring no more than two generations (6 years) for recovery to the original population status. The probability of one or more spills of 10,000 bbl occurring over the 30-year life of the proposal ranges from 11 percent in the Beaufort Sea to 38 percent in the Chukchi Sea.

e. Impacts on Marine and Coastal Birds

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect endangered and threatened birds. It is expected that OCS offshore flights will not disturb endangered and threatened birds because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. It is expected that vessel traffic will not disturb endangered and threatened birds because it occurs in/out of existing port areas greater than one-half mile from critical habitats. It is expected that construction of pipeyards and terminals will not disturb or displace endangered and threatened birds because they will not be constructed in critical habitat within upland or wetland areas.

Accidental events such as oil spills and loss of trash and debris may adversely affect endangered and threatened birds. Three oil spills greater than or equal to 1,000 bbl would occur from the program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These tanker spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas.

It is assumed that the combination of lessees obeying special MMS prohibitions and enactment of MARPOL, Annex 5, greatly reduces if not eliminates future OCS-related loss of trash and debris. The effect on endangered and threatened birds from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 birds. The effect on endangered and threatened birds from oil spills is expected to be primarily sublethal and less than one generation in duration with fewer than five deaths of the brown pelican and piping plover. All deaths of endangered and threatened birds affected by spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: As a result of this alternative, there will be no discernible decline in an endangered or threatened bird population or species, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil, and the probability of a spill (10,000 bbl or more) ranges up to 18 percent.

(b) Nonendangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect marine and coastal birds. OCS offshore helicopter flights will not disturb marine and coastal birds because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. Vessel traffic will not disturb marine and coastal birds because it occurs in/out of existing port areas. The new pipeline landfalls and piping through coastal areas are estimated to affect 27 ha of marine and coastal bird habitat. It is expected that construction of pipeyards and terminals will not disturb or displace marine and coastal birds because they will be constructed in upland areas and not in wetlands. It is expected that pipeline landfalls will disturb and/or displace marine and coastal birds within and from, respectively, 27 ha of coastal area.

Accidental events such as oil spills and loss of trash and debris may adversely affect marine and coastal birds. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. The projected tanker spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. It is estimated that the pipeline oil spill will contact and affect 50 km of beach, 25 km of inshore shoreline, and 16 ha of wetlands. It is estimated that small oil spills will contact and affect 100 ha of estuaries. Lethal effects are expected for no more than 100 birds from direct oiling. Sublethal effects are expected for no more than 1,000 birds from contact with oil and contamination of food sources.

CONCLUSION: As a result this alternative, there will be no discernible decline in a marine or coastal bird population or species, and no change in distribution or abundance. Any affected individuals, by death or sublethal effects, will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil and the probability of their occurrence (10,000 bbl) ranges up to 18 percent.

(2) Alaska Region

(a) Threatened or Endangered Species

1) Arctic and American Peregrine Falcons

Because the scenario for Alternative III is the same as Alternative I in areas within the range of arctic and American peregrine falcons, effects on these species due to Alternative III would be as discussed for Alternative I.

CONCLUSION: Based on the assumptions for Alternative III, noise associated with the base case is estimated to lead to abandonment of up to 50 percent of the peregrine falcon nest sites, and cause a reduced rate (up to 50 percent) of reproduction. Assuming that one or more of the assumed spills for the base case contacts feeding areas for peregrine falcons, the spills would indirectly affect from up to 50 percent of the peregrine falcon population in Alaska and would result in up to 50 percent mortality. This decline in species numbers would last longer than 5 years. There is an 18 to 62 percent chance of one or more spills of 10,000 bbl or greater occurring in Alaska over the 30-year life of the proposal.

2) Short-Tailed Albatross

Because Alternative III involves the same level of exploratory and production activity as the base case (within the range of the short-tailed albatross), it is estimated that it would result in the same level of effects as that of the base case. This would amount to noise disturbance, entanglement in debris, or consumption of plastics affecting about 2 percent of the albatross population each year. The majority of these effects would be sublethal.

Because Alternative III involves the same number of oil spills as in Alternative I within the range of short-tailed albatross, there would be no change in estimated effects due to oil spills (lethal effects on between 1 and 25 percent of the population, depending on the number of birds feeding in the area). The decline in species numbers would last longer than 5 years.

CONCLUSION: Based on the scenario for Alternative III, disturbance, entanglement in debris, and consumption of plastics is not expected to affect more than about 2 percent of the short-tailed albatross population. The majority of these effects would be sublethal. Oil spills associated with Alternative III could lethally affect up to 25 percent of the population depending on the number of birds feeding in the area. The probability of an oil spill of 10,000 bbl or greater occurring in the habitat of the short-tailed albatross ranges from 18 to 62 percent.

(b) Nonendangered Species

1) Bald Eagle (Alaska Population)

Oil spills, and subsequent containment and cleanup operations, are the only source of adverse impact on the bald eagle pertinent to this alternative. The alternative differs from the proposal (Alternative I) in assuming that one less oil spill originating from a tanker serving the TAP will occur along the coast of northern California.

One less oil spill affecting bald eagles south of Alaska is not expected to cause less of an impact on the Alaskan population, and thus, the impact of Alternative III remains the same as the proposal, requiring three or more generations for recovery of the population to its original status. If the number of spills in the Gulf of Alaska were reduced, impacts on the eagle population would be expected to decline, requiring two or more generations for recovery.

CONCLUSION: Overall impact on the Alaskan bald eagle population (potential loss of 50 to 75 individuals) resulting from this alternative (fewer sales in the Beaufort and Chukchi Planning Areas) is expected to be the same as the proposal (Alternative I), requiring three or more generations (15 years) for recovery of the population to its original status. Oil spills are the primary cause of impacts. The probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal ranges from 18 percent in Cook Inlet to 62 percent in the Gulf of Alaska.

2) Waterfowl

DIVING DUCKS: Aircraft and vessel operations in support of offshore drilling and production facilities, deposition of fill material, dredging for pipeline laying, and activities associated with shore-base operation are the principal sources of diving duck disturbance that are expected to be less under Alternative III because the number of platforms changes from three to two and seven to four in the Beaufort and Chukchi Seas, respectively, with this alternative. The estimated number of oil spills, and subsequent cleanup operations, is reduced from one to zero and three to one in the Beaufort and Chukchi Seas, respectively, and one less spill from a tanker serving the TAP is assumed to occur in California.

Fewer platforms in the Beaufort and Chukchi Seas is expected to reduce somewhat the area between these sites and shore bases over which aircraft could disturb diving ducks as well as the total number of overflights and the total area surrounding industrial sites that are degraded with muds and cuttings disposal or rendered unavailable due to disturbing activities. However, activities disturbing to diving ducks (e.g., aircraft overflights) still may occur in the vicinity of duck breeding-, molting-, or migration-concentration areas, thereby diminishing the overall reduction in disturbance occurring elsewhere. Disturbance losses resulting from this alternative are expected to be somewhat less from the proposal (Alternative I), but overall impact on diving ducks would decline minimally because of their generally large populations and substantial reproductive potential but still would require less than one generation for recovery to the original population status.

Under this alternative, impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea, the single estimated oil spill remaining is not expected to contact large diving duck concentrations, although the potential exists for the spill to be transported into openings in the pack ice where birds may be concentrated during migration. Potential impacts of oil spills elsewhere in Alaska remain unchanged. Overall impacts caused by an oil spill are expected to be somewhat less than from the proposal but would still require several generations for recovery. Elimination of one tanker spill along the Pacific coast is expected to substantially decrease losses among wintering diving ducks.

CONCLUSION: Overall impacts on diving duck populations (losses of several thousand, up to 10,000 individuals in areas of concentration) resulting from Alternative III (fewer sales in the Beaufort and Chukchi Planning Areas) are expected to be slightly less than from the proposal (Alternative I), and require less than one generation (2 to 4 years) for recovery to the original population status. Impacts caused by oil spills are expected to be somewhat less than from the proposal, but still require several generations for recovery of the populations. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of diving ducks over the 30-year life of the proposal.

GEESE: Aircraft and vessel operations in support of offshore drilling and production facilities, deposition of fill material, dredging for pipeline laying, and activities associated with shore-base operation are the principal sources of goose disturbance that are expected to be less under Alternative III because the number of platforms changes from three to two and seven to four in the Beaufort and Chukchi Seas, respectively, with this alternative. The estimated number of oil spills, and subsequent cleanup operations, is reduced from one to zero and three to one in the Beaufort and Chukchi Seas, respectively, and one less spill from a tanker serving the TAP is assumed to occur in California.

Fewer platforms in the Beaufort and Chukchi Seas is expected to reduce somewhat the area between these sites and shore bases over which aircraft could disturb geese as well as the total number of overflights and the total area surrounding industrial sites that is rendered unavailable due to disturbing activities. However, activities disturbing to geese (e.g., aircraft overflights) still may occur in the vicinity of goose breeding, molting, or migration concentration areas, thereby diminishing the overall reduction in disturbance occurring elsewhere. Disturbance losses resulting from this alternative are expected to be somewhat less than from the proposal (Alternative I), but overall impact on geese would decline minimally because of their generally large populations and substantial reproductive potential, and they still would require less than one generation for recovery to the original population status.

Under this alternative, impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea, the single estimated oil spill remaining is not expected to contact large goose concentrations, although the potential exists for the spill to be transported into openings in the pack ice where birds may be concentrated during migration. Potential impacts of oil spills elsewhere in Alaska remain unchanged. Overall impacts caused by an oil spill are expected to be somewhat less than from the proposal but would still require one or more generations for recovery. Elimination of one tanker spill along the Pacific coast is expected to result in a minor decrease in losses to wintering brant.

CONCLUSION: Overall impacts on goose populations (loss of fewer than 1,000 individuals) resulting from Alternative III (fewer sales in the Beaufort and Chukchi Planning Areas) are expected to be slightly less than from the proposal (Alternative I) and require less than one generation (3 years per generation) for recovery to the original population status. Impacts caused by oil spills are expected to be somewhat less than from the proposal but would still require one or more generation for recovery of the populations. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of geese over the 30-year life of the proposal.

(3) Pacific Region

(a) Threatened or Endangered Species

1) Bald Eagle (Pacific Population)

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III, Slow the Pace of Leasing, change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to bald eagles would remain the same as outlined for Alternative I. Section IV.D.1.a(5) provides a discussion of potential impacts to the bald eagles and an analysis of the impacts expected as a result of Alternative I.

As with Alternative I, given the extremely rare occurrence of bald eagles along the southern California coast, impacts to this species from routine activities associated with Alternative III are not expected to occur.

A generic discussion of the possible impacts of accidental oil spills on bald eagles is presented in Section IV.A. Based on the impacts of the *Exxon Valdez* oil spill on the Prince Williams Sound population of Bald Eagles in Alaska (see Section IV.D.1.a(5)), an oil spill along the coast of southern California related to Alternative III could result in eagle mortality. However, due to the extreme rarity of this species along the southern California coast, the pipeline or Alaskan tanker oil spill assumed to occur in southern California as a result of Alternative III is not expected to impact this species.

A 30,000 bbl Alaskan tanker spill is also assumed to occur within the Pacific OCS Region, off Washington. A small population (roughly 60-70 pairs) of eagles occurs year-round along the coast of Washington, and a portion of this population could potentially be at risk from a tanker spill. If a tanker spill were to contact the Washington shore or if marine birds and/or mammals were oiled and washed ashore, some eagles could be oiled and mortality could occur. Given the analytical assumptions identified for the Alternative III, tens of eagles are expected to be lost as a consequence of a spill contacting the Washington coast. Because of the relatively slow population growth rates of bald eagles, recovery in this area could take up to 4 years.

CONCLUSION: Routine activities and oil spills assumed to occur as a result of Alternative III in the Southern California Planning Area are not expected to have an impact on threatened or endangered populations of bald eagles. A tanker spill of 30,000 bbl off the coast of Washington is expected to result in injury and death of some bald eagles. Assuming a spill contacted the Washington shoreline, tens of eagles are expected to be lost, with recovery taking up to 4 years. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

2) California Least Tern

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III, Slow the Pace of Leasing, change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to California least terns would remain the same as outlined for Alternative I. Section IV.D.1 provides a discussion of potential impacts to California least terns and an analysis of the impacts expected as a result of Alternative I.

Disturbances to least terns may arise from those activities projected for Alternative III within the Pacific OCS Region that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on least terns (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from this proposal within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Since no new onshore facilities are planned for the Pacific OCS Region under Alternative III and tern colonies are few in number and widely distributed, impacts from air traffic are expected to be negligible.

As with most birds, California least terns are vulnerable to the effects of oil contact. Generic impacts of spilled oil on California least terns are presented in section IV.A. As outlined in Alternative I analysis (Section IV.D.1.a(5)), if an oil spill occurred from May to September and was in the vicinity of a tern colony, as many as 50 pairs or about 5 percent of the population could be affected. Because tern populations have historically increased only very slowly, recovery from the loss of more than a few individuals is expected to take 2-4 years, depending on how severely a colony is affected.

CONCLUSION: Routine OCS-related activities associated with Alternative III are not expected to have an impact on California least terns. The principle impacting agent under Alternative III is spilled oil. Expected outcome of spill contact with a tern colony are losses of up to 50 pairs (5% of the population) and disruption of the colony's reproductive cycle for that year. Because of the very slow rate of change in least tern population size in the last 15 to 20 years, recovery is expected to take 2 to 4 years. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

3) California Brown Pelican

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III, Slow the Pace of Leasing, change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to the California brown pelican would remain the same as outlined for Alternative I. Section IV.D.1.a(5) provides a discussion of potential impacts to the California brown pelican population and an analysis of the impacts expected as a result of Alternative I.

The effect of routine OCS-related oil and gas activities on brown pelicans is expected to be limited to the temporary displacement (i.e., a few days) of a few individuals resting or foraging near platform/pipeline construction sites.

A generic discussion of the possible impacts of accidental oil spills on California brown pelicans is presented in Section IV.A. Because this species forages at sea and sometimes rests on the water, brown pelicans could potentially be vulnerable to the effects of spilled oil. In addition, brown pelicans are often concentrated in nearshore waters, conceivably exposing numerous individuals to a given oil spill. The most serious potential impact of direct contact of oil on brown pelicans is the effect on thermoregulation. Depending on seasonal occurrence, size, and location of an oil spill, from 50 to as many as 1,000 adult pelicans could be oiled, with mortality ranging from 20-50 percent of birds contacted. If the spill occurred during the breeding season and contacted a pelican nesting area, major disruptions in reproduction could be expected, with the potential loss of up to 25% of active nests. Recovery could be expected within 1 to 4 years.

CONCLUSION: The effect of routine OCS-related oil and gas activities assumed to occur as a result of Alternative III in the Southern California Planning Area is expected to be limited to the temporary displacement (e.g., a few days) of a few individuals resting or foraging near platform/pipeline construction sites. The principle impacting agent in the Southern California Planning Area is spilled oil. From 50 to 1,000 pelicans are expected to be oiled, with mortality occurring in 20 to 50 percent of those contacted; recovery is expected in 1 to 4 years. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

4) Light-Footed Clapper Rail

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III, Slow the Pace of Leasing, change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to the light-footed clapper rail would remain the same as outlined for Alternative I. Section IV.D.1.a(5) provides a discussion of potential impacts to the light-footed clapper rail population and an analysis of the impacts expected as a result of Alternative I.

Disturbances to light-footed clapper rails may arise from those activities assumed for the Pacific OCS Region under Alternative III that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on light-footed clapper rails (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from this proposal within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Since no new onshore facilities are planned for the Pacific OCS Region under Alternative III and marshes occupied by this species are few in number and widely distributed, impacts from air traffic are expected to be negligible.

As with most birds, light-footed clapper rails are vulnerable to the effects of oil contact. Generic impacts of spilled oil on light-footed clapper rails are presented in section IV.A. Since light-footed clapper rails seasonally breed in about 14 widely-spaced marshes from Santa Barbara to the Mexican border (USDOI, FWS, 1980b), an oil spill would have to occur and contact the birds at one of these sites. This is considered unlikely, however, as protective equipment (e.g., oil booms) is readily available throughout the rail's range, and oil can generally be prevented from entering estuaries and marshes. Nevertheless, if an oil spill should occur and contact a rail marsh, some mortality is expected. Depending on various factors (spill date, spill size, weather, distance from shore), the impact on light-footed clapper rails could range from a few individuals to the loss of this species from an entire marsh. Due to the continued depressed population of this species, the loss of more than a few individuals could be significant, requiring from 2 to as much as 6 or 7 years to recover.

CONCLUSION: Routine activities and oil spills assumed to occur as a result of Alternative III are not expected to have an impact on light-footed clapper rails.

(b) Nonendangered Species

1) Seabirds

Aircraft and vessel operations in support of offshore drilling and production facilities, deposition of fill material, and dredging for pipeline laying are the principal sources of seabird disturbance that are expected to decrease by reducing the number of platforms from three to two and seven to four in the Beaufort and Chukchi Seas, respectively, with this alternative. The estimated number of oil spills, and subsequent cleanup operations, is reduced from one to zero and three to one in the Beaufort and Chukchi Seas, respectively, and one less spill from a tanker serving the TAP is assumed to occur in California.

Reduction in the number of platforms in the Beaufort and Chukchi Seas is expected to reduce somewhat the area between these sites and shore bases over which aircraft could disturb seabirds, as well as the total number of overflights and the total area surrounding industrial sites that are degraded with muds and cuttings disposal or rendered unavailable due to disturbing activities. However, activities disturbing to seabirds (e.g., aircraft overflights) still may occur in the vicinity of seabird breeding, foraging or migration concentration areas, thereby diminishing the overall reduction in disturbance occurring elsewhere. Disturbance losses resulting from this alternative are expected to be reduced from the proposal (Alternative I) to some extent locally, but overall population impact would decline minimally and still require less than one generation for recovery to the original population status.

Under this alternative, impacts resulting from oil spills are eliminated from the Beaufort Sea. In the Chukchi Sea, the single estimated oil spill remaining is not expected to contact large seabird concentrations, although the potential exists for the spill to be transported into openings in the pack ice where birds may be concentrated during migration. Potential impacts of oil spills elsewhere in Alaska remain unchanged. Overall impacts caused by an oil spill are expected to be reduced somewhat from the proposal but would still require several generations for recovery. Elimination of one tanker spill along the Pacific coast is expected to substantially decrease seabird losses.

Fewer platforms under this alternative is expected to reduce somewhat the area over which aircraft could disturb seabirds as well as the total area surrounding industrial sites that is degraded or rendered unavailable by activities disturbing to seabirds. Overall disturbance impact is expected to decline minimally from the proposal, requiring less than a generation for population recovery. Impacts resulting from oil spills are eliminated from the Beaufort Sea; in the Chukchi Sea, the remaining oil spill is not expected to contact large seabird concentrations but may affect aggregations of migrating birds. Potential impacts of oil spills elsewhere in Alaska remain unchanged. Impacts caused by oil spills, although reduced slightly from the proposal, still are expected to require several generations for recovery of the populations.

CONCLUSION: Overall disturbance of seabird populations resulting from Alternative III (fewer sales in Beaufort and Chukchi Planning Areas) is expected to be reduced minimally from the proposal (Alternative I) and require less than one generation (4 to 5 years) for recovery to the original population status. Impacts caused by oil spills (up to 5 percent of the local breeding populations) are expected to be reduced somewhat from the proposal but would still require several generations for recovery of the populations. There is up to a 62 percent probability that one or more oil spills of 10,000 bbl or greater will occur in the Pacific and Alaska Regions over the 35-year life of the proposal.

2) Shorebirds

Under Alternative III, Slow the Pace of Leasing, the timing and number of sales is different than those identified in Alternative I. In the Pacific OCS Region, the only change from Alternative I is the elimination of the Alaskan tanker spill off northern California. In the Alaska Region, the numbers of sales in the Beaufort and Chukchi Seas are each reduced from two to one. In addition, the remaining sale in the Chukchi Sea is delayed for 2 years, from 1994 to 1996.

This delay and reduction in activity in the Alaska Region will result in 4 less platforms (from 3 to 2 in the Beaufort Sea, and 7 to 4 in the Chukchi Sea) and accompanying decreases in associated activities. Potential impacts to shorebirds from routine activities under Alternative III in the Alaska Region are likely to decrease somewhat from those discussed for Alternative I. These activities include air traffic, pipeline construction, and onshore support-facility construction and operations. Section IV.D.1.a(5) provides a discussion of potential impacts on shorebird populations and an analysis of the impacts expected as a result of Alternative I.

As in Alternative I, routine activities in the Pacific OCS Region are expected to result in only temporary (i.e., a few weeks) disruptions in the foraging or resting behavior of shorebirds within the immediate vicinity (i.e., within 0.5 km) of helicopter flight paths. Air traffic in the Alaska OCS Region is expected to cause disruptions in reproduction of local (i.e., within 0.5 km of flight paths) shorebird populations, with recovery expected within 1 year. Within the Alaska OCS Region, the construction of pipeline landfalls and onshore facilities is expected to be at the same level of activity as Alternative I. Pipeline landfalls are expected to cause the displacement of shorebirds from the area immediately adjacent to the construction (within a few hundred meters) for about 6-8 weeks. Construction of onshore facilities could result in displacement of shorebirds within about 0.5 km of construction and the loss of about 10-15 hectares of habitat from each planning area. A temporary (i.e., less than 1 year) reduction in local productivity may result if nesting habitat were lost to construction. Because of the widespread distribution of most shorebird species in Alaska and the very small amount of habitat potentially affected, however, construction activities are not expected to cause a long-term (i.e. 1 year), measurable impact to shorebird populations. Existing legislative constraints and permitting procedures would serve to further minimize these localized effects.

The only change in the oil spill assumptions from Alternative I for the Pacific OCS Region under Alternative III is the elimination of an assumed Alaskan tanker spill off the coast of northern California. Since the northern California spill under Alternative I was determined to have no effect on shorebirds, the impact of oil spills on shorebirds in the Pacific OCS Region are expected to be the same as for Alternative I (loss of a few to about 500 birds and recovery within 1 year).

The impact of most of the spills from Alaska production is expected to be similar to those for the Southern California Planning Area as discussed for Alternative I. However, a few areas along the Alaskan coast stand out as being of particular importance to shorebirds, including the North Slope along the shores of the Arctic Ocean (an important shorebird breeding and staging area), the Yukon–Kuskokwim River Delta, and the Seward Peninsula-Copper River Delta region. Because of the higher shorebird densities found in these areas, the effect of a spill contacting one of them could be greater than with spills in other areas.

Oil spill contact with North Slope shorebird populations would most likely originate from a pipeline spill of 25,000 bbl assumed for the Chukchi Sea Planning Area. If a pipeline or platform spill were to contact the North Slope shoreline from May through September, a few hundred to a few thousand shorebirds could be affected. Because of the high reproductive potential of most shorebird species, populations should recover in 1-2 years.

The Yukon-Kuskokwim River Delta region is located mostly within the St. Matthew-Hall Planning Area.

The Seward Peninsula-Copper River Delta region would most likely be affected by a tanker spill assumed to occur in the Gulf of Alaska Planning Area from proposed development in the Chukchi Sea Planning Area and by a tanker spill assumed to occur from proposed development in the Gulf of Alaska Planning Area. If a tanker spill were to contact the Seward Peninsula coastline or the Copper River Delta from May through September, a few hundred to a few thousand shorebirds could be affected, with recovery occurring in 1-2 years.

Oil spills assumed for other Alaska OCS Region planning areas are either not expected to contact shore (30,000 bbl tanker spill in the Navarin Basin Planning Area) or are expected to affect no more than a few hundred shorebirds with recovery occurring in less than 1 year (see Section IV.A.4).

CONCLUSION: Impacts on shorebirds from routine OCS-related activities assumed for the Pacific OCS Region are expected to be limited to temporary (i.e., a few weeks) disruptions in the foraging or resting behavior of those shorebirds in the immediate vicinity (i.e., within 0.5 km) of helicopter flight paths. The effects of air traffic in the Alaska OCS Region is expected to be limited to disturbance of local (i.e., within 0.5 km of flight paths) shorebird populations with some local reductions in productivity, and recovery occurring within 1 year. Construction activities assumed for the Alaska OCS Region are not expected to cause a measurable impact to shorebird populations, although a temporary (i.e., year) reduction in productivity within 0.5 km of construction is expected.

The principle impacting agent in both the Pacific and Alaska OCS Regions is spilled oil. Assuming oil contact with the shoreline, injury and mortality of shorebirds are expected to occur, involving a few to as many as 500 individuals, with recovery occurring in 1-2 years. Within the Alaska OCS Region the impact of assumed oil spills on shorebirds is expected to range from less than 100 to a few thousand fatalities, with recovery in 1-3 years. There is up to a 62 percent probability that one or more oil spills of 10,000 bbl or greater will occur in the Pacific and Alaska Regions over the 35-year life of the proposal.

(4) Atlantic Region

(a) Threatened or Endangered Species

Under Alternative III special protections would be in place for the protection of endangered and threatened marine and coastal birds. Should concerns develop with respect to proposed operations, the Regional Director may require the lessee to undertake assessments of the extent of the resource affected, and the degree of impact which may be expected. The findings of these actions may result in modification of Alternative III activities.

Potential impacts due to routine OCS gas and oil activities include disturbances from noise, geophysical surveys and support vessel and aircraft traffic, the presence of offshore structures, muds and cuttings discharges, and pipeline construction activities.

Routine operational activities are not expected to result in fatalities or sublethal impacts on individual birds and, therefore, it is expected to result in only discernible impacts on endangered and threatened bird populations. Noise may cause startle reactions and temporary avoidance behaviors, however, no displacement from critical habitat or disruption of important behavior is expected. Likewise, geophysical surveys, vessel traffic, and helicopter flights may contact individual birds within their respective habitats and cause short-term avoidance behavior. Such impacts are not expected to displace, or otherwise measurably affect, endangered and threatened bird populations on the Atlantic OCS. The presence of offshore structures as potential source of lethal impacts due to collisions or attraction of birds to artificial lights is discussed in Section IV.D.1.a(5). Based on that analysis, it is not expected the presence of 4 offshore platforms would produce measurable impacts to those endangered birds which migrate or reside in pelagic habitats. Muds and cuttings discharges are non-toxic and are rapidly diluted in offshore waters due to currents. No measurable impacts on endangered birds such as the roseate tern, peregrine falcon, and Bermuda petrel are expected to occur from this source. Pipeline construction is a short-term activity relative to the 30 year duration of the Alternative III. Expected impacts from this activity are similar to those associated with offshore platforms (e.g., noise, lights, collision risks). As with platforms, no measurable impacts on either pelagic or coastal endangered and threatened species are anticipated. Pipeline landfall sites are not assumed to be located in critical habitat of bald eagles, piping plovers, or peregrine falcons. No impacts on these species due to bringing the pipeline ashore are expected.

The assumed 10 chronic operational discharges would most likely occur at platform sites. However, were a few operational discharges to occur at supply bases or in coastal/nearshore waters, it is not expected that any endangered bird species would be contacted by spilled materials. Supply bases are assumed to be established at existing facilities. Such sites do not normally support endangered species. Spills in coastal waters contacting shoreline in certain areas could result in the exposure of bald eagles or piping plovers to spilled hydrocarbons but this is considered highly unlikely. Were either bald eagles or piping plovers to contact an operational spill it is possible that a very few individuals could be killed. However, if contacted by an operational spill it is not expected that the affected individuals would experience more than sublethal impacts in the form of staining (see Sections IV.D.1.a(5) and IV.A).

The remaining operational discharges and the small spill assumed for this scenario are expected to occur offshore. Both chronic operational spills and the single small spill would be expected to disperse fairly rapidly. Evaporation quickly reduces spilled materials by removal of volatile fractions. Wind and wave action also act to break up a slick and dilute the concentration of oiled water to levels at which impacts would not be expected. Among the species which occur offshore in the mid- and south Atlantic, none is considered particularly vulnerable to oiling due to their feeding behavior, migratory patterns, distribution, and other biological attributes (see Section IV.D.1.a(5)). Because these assumed spills would be unlikely to contact more than a very few individuals of the endangered and threatened bird species of the Atlantic OCS, no measurable impacts on these species or their populations are expected under Alternative III.

Even in the absence of special protections, no measurable impacts on endangered and threatened birds are expected to occur.

CONCLUSION: No measurable changes in the population size, distribution, or behavior of endangered and threatened birds are expected under Alternative III.

(b) Nonendangered Species

Special protections for nonendangered and nonthreatened marine and coastal birds would be in effect under Alternative III. Should specific concerns be identified, the Regional Director may require the lessee to undertake actions to determine the extent of the resource being affected and the degree of impact which may be expected. The results of these actions may result in the modification of the activities related to Alternative III.

Potential impacts associated with routine OCS gas and oil activities which could affect marine and coastal bird species are the same as those described for Alternative I and for the endangered and threatened birds. Potential sources of impacts which would be expected include noise, geophysical surveys, vessel and aircraft traffic, the presence of structures and artificial lights offshore, muds and cuttings discharges, and pipeline construction.

Noises represent the most likely source of impact on nonendangered and nonthreatened birds. Impacts due to noises will likely cause startle reactions and temporary avoidance behavior. Sources of noise impacts include geophysical surveys, support vessel traffic, and helicopter flights. Noise impacts are not expected to occur in any critical habitat nor are they expected to disrupt any important behavior. Noise impacts are considered sublethal and are not expected to discernibly affect nonendangered and nonthreatened bird populations in coastal or pelagic habitats.

The potential impacts associated with the presence of offshore platforms and artificial lights is discussed in Section IV.D.1.a(5). Based on the location of the area under consideration to lease platforms are not expected to impact, coastal birds, including seabirds, shorebirds, waterfowl, and wading species. Among pelagic birds there are certain species of petrels which, because of an early post-fledgling attraction to lights, have been thought to be vulnerable to collisions with structures. No evidence of pelagic seabird collisions with offshore structures exist which support this concern. It is considered that the 4 platforms which would be placed offshore under Alternative III will not represent a measurable source of impact for certain species of petrels or other pelagic birds.

Muds and cuttings discharges are non-toxic. These materials are rapidly diluted in the currents encountered offshore. No measurable impacts are expected on nonendangered and nonthreatened pelagic birds. Coastal species would be unaffected by these discharges.

Collisions with pipelaying platforms are not expected nor are other potential sources of impacts (e.g. noise and support vessel traffic) expected to result in measurable changes in the population size, distribution, or behavior of nonendangered and nonthreatened birds.

Accidental discharges in the form of the 10 chronic spills and 1 small spill is expected to contact some nonendangered and nonthreatened birds due to the large number and widespread distribution of these animals in coastal and pelagic waters. Most of the assumed spills are expected to occur offshore, although a few could occur at supply bases or within coastal waters.

Contact with spilled oil or refined hydrocarbons is expected to result in lethal or sublethal effects on birds, depending on the location of the spill, the time of year, and type of material spilled. Certain species are less vulnerable than others. For example, those which are aerial feeders, do not contact water frequently; and species which are solitary in habit are not as likely to contact oiled water as those which spend a substantial portion of their time on the water and are gregarious (see Section IV.D.1.a(5)). While it is not possible, for reasons discussed in Sections IV.D.1.a(5) and IV.A, to predict the number of birds which might be affected by an assumed spill or spills, it is not likely that the accidental discharges assumed for Alternative III would result in measurable impacts on nonendangered and nonthreatened bird populations on the Atlantic OCS.

Even in the absence of special protections, no measurable impacts on nonendangered and nonthreatened marine and coastal birds are expected to occur.

CONCLUSION: No measurable changes in the size, distribution, or behavior of nonendangered and nonthreatened marine and coastal bird populations on the Atlantic OCS are expected under Alternative III.

f. Impacts on Fish Resources

(1) Gulf of Mexico Region

(a) Gulf Sturgeon

Accidental events such as oil spills assumed in the scenario for Alternative III may adversely affect Gulf sturgeon. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. The projected tanker spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Numerous small spills are assumed to occur and disperse rapidly along a stretch of coast extending from western Mississippi to eastern Texas. Less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. The pipeline spill will contact and affect 16 ha of estuaries. The small oil spills will contact and affect 100 ha of estuaries. It is assumed that the larger size class oil spills will not contact Gulf sturgeon due to their limited home range. Only sublethal effects on Gulf sturgeon are expected from contact with small oil spills.

CONCLUSION: As a result of the this alternative, the effect on Gulf sturgeon is expected to be undetectable and recovery from any sublethal effects will require less than one year.

(b) Other Fish Resources

A number of routine events such as operational discharges, structure removals, and seismic surveys may adversely affect fish resources. It is assumed that offshore discharges of drilling muds and produced waters will rapidly dilute to background levels and not affect fish resources. Lethal effects to demersal species resulting from explosive platform removals would occur up to 50 m from the detonation site and sublethal effects to fish with internal air chambers extend to 150 m. It is assumed that only airguns will be used in seismic surveys as a result of the proposed action and not affect fish resources.

Accidental events such as oil spills and subsurface blowouts may adversely affect fish resources. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. This spill will contact and affect 16 ha of estuaries; whereas, the smaller oil spills will contact and affect 100 ha of estuaries. Less than five small OCS-related spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. Both lethal and sublethal effects on fish resources are expected from oil spills. It is estimated that a total of 21 subsurface blowouts will occur and assumed that blowouts cause lethal effects on fish resources within 50 m and sublethal effects within 150 m of the blowout site.

CONCLUSION: As a result of this alternative, the effect on fish resources is expected to be undetectable to estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters, to pelagic species such mackerels, cobia, bluefish, amberjack, and dolphin fish, and to reef fish species such as grouper, snapper, gag, scamp, and seabass. Any loss of fish resources will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil, and the probability of their occurrence (10,000 bbl or greater) ranges up to 18 percent.

(2) Alaska Region

(a) Pacific Salmon (Alaska Population)

Because the scenario for Alternative III is the same as Alternative I in areas within the range of Pacific Salmon, effects on these species as the result of the adoption of Alternative III would be as discussed for Alternative I.

CONCLUSION: Routine activities assumed for Alternative III are expected to have no measurable effect on salmon. Oil spills contacting migratory salmon populations could have adverse impacts on small segments of these fish. The numbers so affected would be small in proportion to the total; and any oil spill would have only a small-scale, small-area, and short-time effect. There is an 18 to 34 percent chance of one or more spills of 10,000 bbl or greater occurring throughout the pelagic range of migratory salmon over the 30-year life of the alternative.

(b) Walleye Pollock

Because the scenario for Alternative III is the same as Alternative I in areas within the range of Walleye Pollock, effects on these species as the result of the adoption of Alternative III would be as discussed for Alternative I.

CONCLUSION: The level of oil and gas exploration/development for Alternative III is not expected to have an appreciable effect on groundfish populations.

(c) Arctic Cisco

Fewer lease sales would reduce the intensity at which oil and gas exploration and development would occur with subsequent decreased impact on the limited fish resources of the arctic area. Beaufort Sea arctic cisco populations are quite variable in number with no measurable effects from commercial harvest or development impacts identified to date. Predictions, however, are for an impending decline during the early 1990's with subsequent marked increases (Gallaway, 1989). The species may always have shown this variation in population numbers with no known environmental causative factors.

Drilling discharges and offshore construction (platforms and pipelines) would be reduced in mass, number, and length (pipelines) if this alternative were implemented. The arctic cisco, a major pelagic finfish of the Beaufort sea, but absent from the Chukchi Sea, would not be affected to any measurable degree from benthic alterations from these routine activities. Further reductions do not change the virtual no effect on arctic cisco from these discharges and construction.

CONCLUSION: Based on the assumptions for Alternative III, no appreciable adverse effects are expected for arctic cisco in the Alaska Region.

(d) Other Fish Resources

Because the scenario for Alternative III is the same as Alternative I in areas, effects on these species as the result of the adoption of Alternative III would be as discussed for Alternative I.

CONCLUSION: The level of oil and gas exploration/development activity assumed for Alternative III is not expected to have an appreciable effect on other finfishes of the Alaska Region.

(3) Pacific Region

(a) Pacific Salmon (Pacific Population)

If Alternative III, Slow the Pace of Leasing, were selected, most of the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. All impacts on commercial fishery resources from both normal development and accidental causes are expected to be about the same in the Southern California Planning Area and Washington as for Alternative I. Impacts to Pacific salmon populations within southern California from normal OCS activities associated with Alternative III would be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernible change of population levels. The assumed pipeline oil spill and two of the three tanker oil spills are expected to result in lethal or sublethal effects to the salmon population that would not be discernible from natural variations of pelagic offshore salmon. The tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of salmons in the stream affecting the impacted year class for two to four years. However, regional impacts would not be discernible from natural variations of populations within the area.

Elimination of the tanker spill in northern California will eliminate the lethal or sublethal effects to the salmon populations described in Alternative I.

CONCLUSION: Adoption of Alternative III would eliminate the very low lethal or sublethal effects that would not be discernible from natural variations of salmon populations typical of the area.

(b) Steelhead Trout

If Alternative III, Slow the Pace of Leasing, were selected, most of the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. All impacts on commercial fishery resources from both normal development and accidental causes are expected to be about the same in the Southern California Planning Area and Washington as for Alternative I. Impacts to steelhead trout populations within southern California from normal activities would involve changes in the distribution of some migrating populations for a period of minutes to hours with no discernible change of population levels. The pipeline oil spill and two of the three tanker oil spills are expected to result in lethal or sublethal effects to the steelhead trout population that would not be discernible from natural variations of pelagic offshore steelhead trout. The tanker oil spill contacting the entrance of a steelhead spawning stream in Washington or southern California (San Luis Obispo County), would result in a reduction of 10-20 percent of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regional impacts would be less, since not every stream would be affected and the relative number of the affected population would be lessened, and would not be discernible from natural variations of steelhead trout populations within the area.

The elimination of the tanker spill in northern California will eliminate the lethal or sublethal effects to the steelhead trout population offshore northern California that were described in Alternative I.

In Alaska, this alternative would not change the minor impacts which described for Alternative I. Although steelhead trout range into the Alaska region as far as the Bering Sea and Bristol Bay, they are very uncommon north of southern British Columbia, Canada. In any region of Alaska, they are extremely rare, but, because of their large populations elsewhere on the Pacific coast, they are not threatened or endangered, forming a minor, portion of the pelagic community. Impacts from the Alaskan oil spills, therefore would not be distinguishable from natural population fluctuations, if impacts were to occur at all.

CONCLUSION: Adoption of Alternative III would eliminate the lethal or sublethal effects offshore northern California. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(c) Pacific Whiting

If Alternative III, Slow the Pace of Leasing, were selected, most of the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. Impacts to Pacific whiting populations within southern California from normal activities associated with Alternative III are expected to be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernible change of population levels. The oil spills assumed for the alternative are expected to result in lethal or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

It is assumed there will be one less 30,000 bbl tanker spill of Chukchi Sea transported oil occurring over 80 km (50 miles) from shore off northern California. The elimination of the tanker spill in northern California will eliminate lethal (less than 10 percent of the population) or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

As discussed in Alternative I, whiting are uncommon in the Alaska region and oil spills were not expected to result in any changes that would be distinguishable from natural population fluctuations. Alternative III would result in no change.

CONCLUSION: Adoption of Alternative III would eliminate lethal or sublethal effects on whiting populations both locally and regionally due to the elimination of the assumed tanker spill off northern California. Under Alternative III the impacts are not expected to result in any change to Pacific whiting population that would be distinguishable from natural population fluctuations.

(d) Other Fish Resources

If Alternative III, Slow the Pace of Leasing, were selected, most of the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. All impacts on fish resources from both normal development and accidental causes are expected to be about the same in the Southern California Planning Area and Washington as for Alternative I. Routine activities associated with the proposal (installation and operation of manmade structures, effluents and discharges from drilling discharges, underwater noise from geophysical surveys) could result in reductions of some local fish populations, but with no lasting effects on trophically dependent species. Recovery of affected local populations would occur within 2 years. The oil spills are expected to result in lethal or sublethal effects locally in the area of contact. Recovery of affected local populations would occur within 2 years. The tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for two to four years. Regionally, lethal or sublethal effects would not be discernible from natural variations of fish populations within the area.

The elimination of the tanker spill in northern California will eliminate mortalities of egg and larvae of some species within the contact area of the spill (locally) resulting in population decreases requiring a complete breeding cycle to recover to pre-spill size. On a regional level, the effects on fish populations are expected to be inconsequential and would not be discernible from natural variations of fish populations within the offshore area.

CONCLUSION: Adoption of Alternative III would eliminate mortalities of egg and larvae of some species within the contact area of the spill (locally) resulting in population decreases requiring a complete breeding cycle to recover to pre-spill size. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal. There is up to a 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(4) Atlantic Region

Impacts on fish resources can result from the discharge of formation or produced waters, muds, cuttings, and other operational emissions; structure emplacement and removal; lights and noise on offshore structures; and geophysical surveys.

It is assumed that the Regional Director would invoke any necessary special protection for fish resources under the general biological stipulation, as needed. Species and habitats that may be at risk and possible methods for safeguarding fish resources are discussed in Section IV.D.1.a(6).

It is assumed that small operational hydrocarbon spills (<1 to 50 bbl) will occur and potentially cause lethal or sublethal effects on fish eggs, larvae, juveniles, and adults in the immediate vicinity of these spills.

Drilling discharges from 97 wells will occur under Alternative III. Potential effects of these discharges on fish resources are discussed in Section IV.D.1.a(6)). Only water-based muds are permitted to be discharged under NPDES regulations, and most such muds are relatively nontoxic. Sublethal or lethal effects on ichthyoplankton may occur on the order of 10's or 100's of meters from the discharge point (NAS, 1983; Neff, 1987b). Treated sanitary and domestic wastewaters and deck drainage near the point of discharge would be expected to cause sublethal effects on plankton supporting the food web for fish resources, as discussed in Section IV.D.1.a(6). However, effects would be sufficiently localized and minor such that no effects, even on individual fish higher in the food web, would be expected.

Pipelaying is the principal mechanical disturbance assumed under Alternative III. Under the assumption that 182 km (113 mi), one third of the total trunkline mileage, requires burial because it is inside the 60-m (197-ft) isobath, burial would disturb about 3.6 km^2 (1.4 mi^2) of bottom habitat, as calculated in Section IV.D.1.a(6). In contrast, as discussed in that section, habitat for benthic organisms such as surf clams is very large. Thus, no impacts on whole populations of shellfish or benthic forage organisms for demersal predatory fish are anticipated.

Under Alternative III, four platforms are assumed. These structures, as discussed in Section IV.D.1.a(6), could aggregate fish or increase fish production. Only about 0.08 km^2 (0.03 mi^2) of bottom area would be disturbed by all 4 platforms combined. Therefore, only impacts to individual organisms and not to whole populations are expected. A total area of at least 1.2 km^2 (0.5 mi^2) would be affected by the use of bulk explosives to remove all 4 platforms; other methods would affect less area but could only be used under certain conditions. Impacts of airguns used in geophysical surveys are discussed in Section IV.D.1.a(6). Physiological stress or lethal impacts occur only within a range of about 1.5 m (5 ft) of an airgun. Impacts of other man-made noises emitted from sources such as ship propeller cavitation and engines are discussed in Section IV.D.1.a(6). Sound originating from OCS activities would affect fish behavior only near their sources and hence would not depress whole fish stocks. Lights on offshore structures attract some fish but may disrupt diel vertical migrations in deep water by other species, as discussed in Section IV.D.1.a(6). However, as with man-made sounds from airguns and other sources, impacts on whole stocks are not expected.

Formation water may be discharged during gas or oil production; or during or after drilling operations. Impacts of such discharges are discussed in Section IV.D.1.a(6). If necessary, formation water can be reinjected into deep rock strata. Minor osmotic stress from hypersaline formation water within a few meters of the point of discharge could occur, but no serious effects on fish in the water column are expected.

Under Alternative III, an average of 10 spills of <1 to 50 bbl and 1 spill of >50 to <1,000 bbl are assumed. Impacts of oil spills on fish resources are discussed in Section IV.D.1.a(6). Oil may be taken up, metabolized, and excreted by fish, but some metabolites are known carcinogens. The most serious effects of oil spills are on shorelines in quiet water, where recovery has been observed to take from 2 to about 12 years (Teal and Howarth, 1984). However, a small spill will not produce a high concentration of oil in the sediment and the length of shoreline contacted will be minute relative to the total length of shoreline in the Mid-Atlantic and South Atlantic Bights. A small oil spill may contact planktonic fish eggs and larvae. The location and time of year of the spill would determine the species affected. In summary, sublethal or lethal effects on individual eggs, larvae, juveniles, or adults can occur. However, whole stocks are not expected to be measurably affected.

Installation and removal of platforms, emplacement of drillship anchors, pipelaying, and discharge of drill cuttings can disrupt Atlantic calico scallop beds and the attached biota of live bottom areas, if protection by stipulation is not in place. For example, pipelaying could bury 0.1 to > 4.0 percent of an Atlantic calico scallop bed (as calculated in Section IV.D.1.a(6)).

In summary, routine operational discharges can have sublethal effects on fish food organisms near the discharge point. In the first phase of drilling a well, cuttings would bury benthic food organisms within 10's of meters of the wellhead. Jetting and trenching for pipeline emplacement would disturb about 3.6 km^2 (1.4 mi^2) of the bottom. Emplacement of all four platforms assumed under this alternative would disturb only about 0.08 km^2 (0.03 mi^2) of bottom. Drilling rigs will be required for each of the 25 exploration and delineation wells assumed under this alternative. Lights and man-made sounds from such rigs and from the four platforms would have impacts confined to the area near the source. Produced waters may osmotically stress fish within a few meters of the point of discharge.

Lethal or sublethal impacts on individual eggs, larvae, juveniles, or adults may result from a small oil spill. Impacts from spilled oil will principally result from inshore contamination of sediment along an affected shoreline in quiet waters.

CONCLUSION: Individual fish may experience sublethal impacts or mortality, and the expected duration of impacts under Alternative III is less than 1 to 3 years. Fish populations in the local area of oiled shorelines may require 2 to about 12 years to fully recover. No measurable declines in whole stocks are expected.

g. Impacts on Reptiles

(1) Gulf of Mexico Region

A number of routine events such as anchoring, structure installation, pipeline placement, dredging, operational discharges, vessel traffic, and explosive platform removals may adversely affect threatened endangered marine turtles. It is expected that effects on marine turtles from anchoring, structure installation, pipeline emplacement, dredging, and operational discharges will be indistinguishable from the long-term (25-50 years) natural variability within populations of marine turtles. It is expected that marine turtles will avoid 5-10 m^2 of live bottom areas for up to a month and that this avoidance of impoverished foraging areas will have no effect on marine turtles. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of marine turtles to visually locate its prey within one km of the discharge point for the short time period (less than one hour) spent traversing the plume. The effects on marine turtles from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on marine turtles beyond 50 m of the detonation of a short-term nature lasting less than one week. No deaths are expected due to industry's compliance with the MMS guidelines for explosive removals.

Accidental events such as OCS-related trash and debris, oil spills, and oil spill response activities may adversely affect marine turtles. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. The effect on marine turtles from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 turtles. The effect on marine turtles from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation. It is expected that the effects from oil spill response activities would be sublethal to marine turtles causing avoidance of 116 ha of oiled coastal areas for one month.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a marine turtle population or species, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil, and the probability of their occurrence (10,000 bbl or greater) ranges up to 18 percent.

(2) Pacific Region

The routine activities and accidental events assumed to occur in the Pacific Region under Alternative III change only slightly from that described for Alternative I (the tanker spill off northern California assumed for Alternative I is not part of the scenario for this alternative). Therefore, expected impacts to sea turtles would remain the same. Section IV.D.1 provides a discussion of potential impacts on sea turtles and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea turtles include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact sea turtle populations. The low sea turtle densities in areas assumed to be affected (particularly north of Point Conception) make it unlikely that these animals would be affected by accidental oil spills; if mortality does occur, it is not expected to be distinguishable from natural variability within the species' populations.

CONCLUSION: Adoption of Alternative III is expected to have no discernible effect on sea turtle abundance or distribution.

(3) Atlantic Region

Special protections for endangered and threatened marine turtles would be in effect for Alternative III. Should conditions arise which cause concerns for this biological resource, the Regional Director may require the lessee to undertake actions to determine the extent of the resource being affected and to what degree the lessees' activities will impact these animals. The results of these actions may result in the modification of the activities considered under Alternative III.

Potential impacts on endangered and threatened marine turtles from routine OCS gas and oil operations include underwater noise (e.g., drilling, vessel and aircraft traffic, and geophysical surveys), collisions or startle reactions caused by ships, startle impacts due to helicopters, the presence of platforms or other structures, muds and cuttings discharges, and pipeline construction. With the exception of collisions between turtles and vessels, the impacts associated with routine operations are sublethal.

Accidental impacts under Alternative III concern the discharge of oil or other hydrocarbons. Over the 30-year timeframe of this scenario, 10 chronic operational discharges (>1 to 50 bbl) are assumed. A single small spill (>50 and <1,000 bbl) is also assumed and expected to occur offshore. No oil spills of 1,000 bbl or more are assumed to occur.

The level of offshore activity assumed for Alternative III is expected to result in lower levels of impact to endangered and threatened marine turtles than those expected under Alternative I. Noise levels will be reduced as there will be fewer platforms, less drilling activity, and fewer vessel and helicopter trips. Less drilling will also reduce the amount of drill muds and cuttings discharged offshore. Pipeline construction activity will not differ Alternative I levels of trunk and gathering line miles. However, as described in Section IV.D.1.a(7), the construction of the pipeline is viewed as a relatively short-term activity and is not repeated.

Accidental oil spills and discharges are also fewer in number under Alternative III than in Alternative I (see Section IV.D.1.a(7)). The majority of the 10 chronic operational spills (>1 to 50 bbl) assumed will likely occur at platforms offshore and therefore could contact a few adult leatherback, or juvenile loggerhead and green turtles. Because of their inshore distribution, it is assumed that offshore spills would not contact adult loggerhead and green turtles, juvenile Kemp's ridley turtles or hawksbill turtles. As described in Section IV.D.1.a(7), contact with oil can produce skin and soft tissue inflammation in turtles and may cause a wide array of physiological disturbances as well. No lethal impacts are expected as a result of chronic operational discharges because evaporation, wind and wave action quickly disperse spilled materials to sublethal impact levels.

As indicated above, one small spill (>50 and <1,000 bbl) is assumed for Alternative III. Individual turtles which contact spilled oil could experience sublethal and possibly lethal impacts from either direct contact with spilled oil or through attempts to ingest tarballs (see Sections IV.A and IV.D.1.a(7)). However, it is not expected that the single small spill assumed for Alternative III would measurably affect any endangered or threatened marine turtle population on the Atlantic OCS.

Even in the absence of special protections, no measurable impacts on endangered and threatened marine turtles are expected to occur.

CONCLUSION: No measurable changes in the size, distribution, or behavior of endangered and threatened marine turtle populations are expected under Alternative III.

h. Impacts on Coastal Habitats

(1) Gulf of Mexico Region

(a) Wetlands and Estuaries

The disposal of OCS-derived produced waters in coastal Louisiana is not expected to affect adjacent wetland areas based on the results of field studies. New dredging and construction projects in wetland areas include pipeline landfalls, navigation channel maintenance dredging and deepening, and new infrastructure construction. The four new pipeline landfalls are expected to affect 27 ha of wetlands. Maintenance dredging and deepening of navigation channels will affect wetlands mainly in coastal Louisiana where wetlands typically fringe navigation routes. In addition, the use of channels by OCS vessels will result in accelerated erosion of as much as 30 ha of wetland fringed channel banks. The construction of one new pipe yard and three new terminals is projected to occur along the south Texas and Alabama coasts where ample amounts of upland occur near the coast. Given the current regulatory environment, it is likely that these facilities will be constructed on coastal uplands rather than wetlands.

Three oil spills greater than or equal to 1,000 bbl would occur (one from program-related activities and two from increased tanker imports due to decreased domestic production). The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Impacts from accidental discharges of oil could affect approximately 100 ha of wetlands, mainly along the western Louisiana to eastern Texas coasts. In the areas affected, damage to wetlands will include temporary die back of the above ground vegetation, some complete plant mortality, and accelerated rates of land loss (the conversion of wetlands to open water).

CONCLUSION: This alternative is expected to result in temporary (one growing season or approximately 6 months) dieback of up to 100 ha of wetlands that have been contacted by spilled oil. Some of these wetland areas could be converted to open water habitat where higher concentrations of oil accumulated resulting in plant death and eventual land loss. The probability of one or more spills (greater than or equal to 1,000 bbl) occurring Gulfwide ranges up to 18 percent. Up to 30 ha of wetlands could be eroded along navigation channels as a result of OCS-vessel traffic within the channels. Most wetland impacts will occur in Louisiana and along the north Texas coast.

b) Barrier Beaches

Construction activities associated with this alternative, including pipeline landfalls, infrastructure construction, and maintenance dredging and deepening of navigation channels, are expected to have minimal impacts. Using proper construction techniques, pipeline landfalls can be done with no observable effects on barrier beaches. New construction projects will not likely be located on barrier beaches or islands. Maintenance dredging and channel deepening may have some erosional effects on beaches downdrift from the navigation channel, but these impacts will be localized.

Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Impacts from accidental discharges of oil could affect approximately 100 ha of wetlands, mainly along the western Louisiana to eastern Texas coasts. Although some contact to barrier beaches from accidental spillage of oil will occur along the Louisiana and Texas coasts, the oil will be cleaned from the beach with no permanent affects on the configuration of the barrier feature.

CONCLUSION: This alternative is not expected to result in permanent alterations of barrier beach configurations, except in localized areas near navigation channels that have been dredged and deepened.

(2) Alaska Region

WETLANDS AND ESTUARIES: Fewer oil spills are assumed to occur under Alternative III than under the proposal in the Beaufort Sea and Chukchi Sea. The number of small spills assumed to occur in the Arctic also is less (from 647 spills of 1-50 bbl under the proposal to 373 spills of 1-50 bbl under this alternative and from 26 spills of 51-999 bbl under the proposal to 14 spills under Alternative III). This alternative potentially reduces the amount of arctic wetland-estuarine habitats contaminated by oil spills by 75 percent from that under the proposal (from perhaps 10-20% under the proposal to 2-5% under Alternative III). Under Alternative III, oil and gas exploration and development activities proposed in the Bering Sea and Gulf of Alaska are assumed to be the same as described under the proposal; thus, effects on estuaries and wetlands in the Bering Sea and Gulf of Alaska are expected to be the same as under the proposal.

Under Alternative III, the primary effects on wetland-estuarine habitats in the Alaska Region are expected to come from a causeway and pipeline-landfall construction and oil spills. Hydrological effects from the causeway (changes in the physical integrity of perhaps 5% of the habitat) and some effects (perhaps 5-10%) on the distribution of species (anadromous fish) are expected to last for more than 10 years. Turbidity effects from pipeline burial on wetland-estuarine habitats are expected to be short term, lasting less than 2 years. Oil-spill contamination of wetland-estuarine habitats is expected to have adverse effects on the biological diversity and productivity of invertebrate communities lasting for more than 10 years.

CONCLUSION: Alternative III is expected to affect wetlands and estuaries in the Arctic subregion (Beaufort and Chukchi Seas) at a severity of about 75 percent that of Alternative I (perhaps a reduction in contaminated habitats from 10-20% under Alternative I to 2-5% under this alternative). However, effects on wetlands and estuaries in the Bering Sea and Gulf of Alaska are expected to be the same as under Alternative I. There is an 18 to 38 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal in the Alaska Region.

(3) Pacific Region

WETLANDS AND ESTUARIES: If Alternative III, Slow the Pace of Leasing, were selected, impacts are expected to be the same as those of the Alternative I (see Section IV.D.1.a(8)). No impacts from normal activities are expected. Although it is unlikely that the assumed oil spill would enter an estuary in southern California, it is possible and is assumed for both southern California and northern Washington. Impacts of an oil spill entering an estuary and remaining for several tidal cycles, will involve destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require at least 5 years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no real interference with ecological relationships in the region. No impacts to estuaries are expected in northern California.

CONCLUSION: Adoption of Alternative III is expected to cause impacts from a tanker spill entering an estuary and remaining for several tidal cycles. Destruction of a major part of the local community is expected, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require at least 5 years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no measurable interference with ecological relationships in the Southern California Planning Area. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal. There is an 18 to 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(4) Atlantic Region

(a) Wetlands and Estuaries

Routine OCS activities that could impact estuaries or wetlands under this alternative stem from supply vessel and tanker traffic to and from drilling rigs and platforms, and from the emplacement of three gas pipelines in the coastal area. The changes in numbers of wells drilled and platforms erected from the Alternative I are not expected to have any change in impact on estuaries and wetlands.

Accidents assumed under this Alternative that could impact estuaries and wetlands, arise from small spills of diesel fuel from supply vessels and small to spills from tankers transporting crude oil to refineries. Supply vessel spills that could impact estuaries and wetlands would most likely occur only in the immediate vicinity of the areas used as support bases. The greatest chance of a spill up to 1,000 bbl affecting estuaries and wetlands would be in the vicinity of refineries. Oil produced on the Atlantic OCS would most likely be transported by tankers to refineries in Delaware Bay or possibly Raritan Bay. An oil spill of 1,000 bbl or greater is not assumed to occur under Alternative III.

Impacts on estuaries and wetlands from vessel traffic related to OCS activities stem from ship wakes eroding the shoreline. Since all vessel traffic is assumed to use established port facilities, impacts are expected to be imperceptible.

Construction of pipelines in the coastal area can affect estuarine and wetland areas. Pipelines coming ashore in the Mid-Atlantic Bight are not likely to encounter estuaries and wetlands but will come ashore in areas where the beach is part of the mainland. This is the case at Seagirt, New Jersey, and

Cape Henry, Virginia. In the South Atlantic Bight, a pipeline would most likely have to pass through some estuarine or wetland environments. Most of the effects from a pipeline are expected to occur during construction. The effects of the various construction methods are explained in Section IV.D.1.a(8)). While complete recovery of the area disturbed during pipeline construction can take several years, the direct impacts affect only a limited area and are temporary. Pipeline corridors are expected to revegetate in 2 years. Proper construction and restoration methods will allow the area to return to preconstruction conditions and are not expected to result in modification of water flow, loss of wetlands, or altered salinity regimes.

Small spills from supply vessels are not expected to affect estuaries and wetlands in the vicinity of the support bases for any more than one growing season. These small spills would be diesel fuel which would evaporate or be cleaned up with sorbents before they could penetrate into the sediment and endanger the root systems of marsh and sea grasses.

Impacts from OCS vessel traffic are expected to be imperceptible. Pipeline construction will temporarily destroy vegetation and habitat along the pipeline corridor. With proper reconstruction, revegetation can occur in 2 years. These impacts are expected only if pipelines come ashore near Wilmington, North Carolina, or Charleston, South Carolina. Impacts from accidents are expected to be limited to temporary changes in flora and fauna compositions caused by small spills in the vicinity of support bases. These will most likely be imperceptible in areas with existing daily ship traffic, such as Atlantic City, New Jersey, and Morehead City, North Carolina.

CONCLUSION: Under Alternative III, impacts on estuaries and wetlands are expected to be imperceptible except in areas disturbed for pipeline construction. Pipeline corridor impacts are expected to affect less than 0.5 percent of the Atlantic estuarine environment.

(b) Shorelines

The existing conditions of the Atlantic shorelines are described in Section IV.D.1.a(8)). Routine OCS activities that could impact shorelines under this Alternative stem from supply vessel and tanker traffic between shore bases and drilling rigs and platforms, and from the emplacement of three gas pipelines in coastal areas. The numbers of wells drilled and platforms erected as a result of Alternative III are not expected to result in have any change in impact on shorelines.

Accidents that can impact shorelines stem from small spills of diesel fuel from supply vessels and spills from tankers transporting crude oil to refineries. Supply vessel spills that can impact shorelines will most likely occur in the immediate vicinity of the areas used as support bases. The greatest chance of a spill less than 1,000 bbl affecting shorelines will be in the vicinity of refineries. Oil produced on the Atlantic OCS will most likely be transported by tankers to refineries in Delaware Bay or possibly Raritan Bay. An oil spill greater than or equal to 1,000 bbl is not assumed to occur under Alternative III.

The wakes from vessels related to OCS activities can cause erosion of the shoreline. Since all vessel traffic is assumed to use established port facilities, these impacts are expected to be imperceptible. The only measurable impact on shorelines expected from the assumed routine activities is from dredging channels through one beach area in the Mid-Atlantic Bight and through two barrier islands in the South Atlantic Bight to allow for pipeline emplacements. The dominant impact would be aesthetic; however, pipeline emplacement would weaken the barrier islands until vegetation is reestablished (approximately 2 to 3 years.). This temporary weakening is not expected to cause the barrier island to be breached by subsequent storms. Proper construction methods will almost certainly prevent this from happening.

It is assumed that a small diesel fuel spill between >1 and <50 bbl will occur in the vicinity of each of the support bases and at the mouth of Delaware Bay. Impacts that could be expected to shorelines, if these spills occur, will be mostly visual and last only for a few days. Most of the diesel fuel is expected to evaporate within one day, with any remaining fuel dissipating from the rapid sand movement that occurs along the Atlantic shorelines. No measurable impact to shorelines is expected from small spills.

CONCLUSION: Under Alternative III, impacts to shorelines will occur only at pipeline landfall locations. The maximum area affected will be a 15 m (50 ft) swath across the beach at each of the 3 landfall locations. Recovery is expected to be complete in 2 to 3 years.

i. Impacts on Seafloor Habitats

(1) Gulf of Mexico Region

(a) Chemosynthetic Communities

Because of the water depths (400+m) at which these communities are found, the only impact-producing factor threatening the chemosynthetic communities is physical disturbance of the bottom, which would destroy the organisms comprising these communities. Such disturbance would come from those OCS-related activities associated with pipelaying, anchoring, structure emplacement, and seafloor blowouts. Only structure emplacement is considered to be a threat, and then only to the high-density (Bush Hill-type) communities. The widely distributed low-density communities would not be at risk. The provisions of NTL 88-11 (currently in effect), requires surveys prior to drilling and avoidance. This will greatly reduce, but not completely eliminate, the risk.

CONCLUSION: The activities associated with this alternative are expected to cause little damage to physical integrity, species diversity, or biological productivity of either the wide-spread low-density chemosynthetic communities or the rarer, widely scattered high-density Bush Hill-type chemosynthetic communities. Recovery from any damage is expected to take less than two years.

(b) Topographic Features

Impact-producing factors resulting from routine activities of oil and gas exploration and development include anchoring, structure emplacement and removal, and operational discharges (muds and cuttings, produced water). These activities may threaten the communities of the topographic features. Because protections similar to that of the topographic features stipulation are assumed to be attached to leases issued as a result of this proposal, operational discharges (drilling muds and cuttings, produced waters) will have no impact on the biota of the banks.

Impact-producing factors resulting from accidents during such oil and gas activities include blowouts and oil spills. These activities may threaten the communities of the topographic features. Because protections similar to that of the topographic features stipulation are assumed to be attached to leases issued as a result of this proposal, such activities cannot occur within the "No Activity Zones," which include all the sensitive reefal habitats. Thus there will be no mechanical damage to reefs resulting from blowouts. Suspended sediments from a blowout may reach the biota of the bank, but in very small amounts that will be swept clear of the bank in a matter of a few hours. Impacts would be sublethal at worst, and recovery would take place within 1-3 days. Oil spills could cause damage to benthic organisms if the oil contacts the organisms and remains in contact for an extended period of time. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. Oil from surface spills will not contact the reefs, and contact from oil is likely only from spills from blowouts, which are rare in the Gulf. As with resuspended sediments, such oil would reach a bank only in very small amounts that will be swept clear of the bank in a matter of a few hours. Impacts would be sub-lethal at worst, and recovery would take place within 1-3 days.

CONCLUSION: The activities assumed for Alternative III are expected to cause little to no damage to the physical integrity, species diversity, or biological productivity of the habitats of the topographic features of the Gulf of Mexico. Small areas of 5-10 m^2 would be impacted, and recovery from this damage to pre-impact conditions is expected to take less than 2 years, probably on the order of 2 to 4 weeks.

(c) Live Bottoms

The impact-producing factors resulting from routine activities of oil and gas operations include mechanical damage caused by underwater oil spills, blowouts, anchoring, structure emplacement and removal, drilling discharges, and pipeline emplacement. These activities may threaten the sessile and the pelagic communities associated with the crest and flanks of the hard bottom and low-relief hard-bottom features of the region. Because protection similar to that of the biological stipulations are assumed to be attached to leases issued as a result of this alternative, the effects from these factors will have been mitigated on the biota of the hard bottoms.

The emplacement of drilling rigs, platforms, and anchors on the seafloor will crush the organisms directly beneath the legs or mat used to support the structure. Structure emplacement and anchor damage from support boats and ships, floating drilling units, and pipeline-laying vessels disturbs areas of the seafloor and is the most serious threat to live-bottom areas at these depths. Structure removal using explosives (the most common removal method) could suspend sediments throughout the water column to the surface and may cause substantial impacts to nearby habitats. Deposition of these sediments would occur largely within the first 100 m of the site. Explosive structure removals create shock waves, which could also harm resident biota in the immediate vicinity. Smothering of organisms through deposition of drilling discharges (drill muds and cuttings) may occur; less obvious sublethal effects may also take place. Pipeline emplacement directly affects the benthic communities through burial and disruption of the benthos, and through resuspension of sediments. These resuspended sediments may clog filter-feeding mechanisms and gills of fishes and sedentary invertebrates. The majority of these impacts are mitigated through implementation of the biological stipulations or comparable measures. Because protection similar to that of the biological stipulations will be attached to leases issued as a result of this proposal, the effects from these factors will have been mitigated on the biota of the region.

Oil spills could cause damage to live-bottom organisms if the oil contacts the organisms and remains in contact for an extended period of time. The potential impacts from spilled oil include uptake of hydrocarbons and reduced visibility; these impacts may be serious or fatal to the local biota. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. Oil from surface spills will not contact live-bottom areas, and contact from oil is most likely only from spills from blowouts, which are rare in the Gulf. A blowout within a 100 m of a hard bottom community could result in the smothering of the biota within a very limited area of a hard bottom due to sedimentation.

This alternative would slightly change some of the OCS-related activities which were detailed for the proposed action. A reduction in the number of exploration and delineation wells would be evident due to the lack of OCS activities in the northeastern Gulf of Mexico. Likewise, a similar reduction in the number of development and production wells, number of platform installations and removals, miles of pipelines installed, and potential oil spills would be seen. However, the live-bottom stipulation effectively mitigates the effects of OCS-activities on hard-bottom communities.

CONCLUSION: The impact of this alternative on the hard bottom trend region is expected to be such that any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 2 to 4 months.

(2) Alaska Region

STEFANSSON SOUND BOULDER PATCH: Alternative III is expected to have the same level of effect on the Boulder Patch benthic communities as the Proposal, Alternative I, because a pipeline oil spill and pipeline burial and causeway construction are assumed to occur in Stefansson Sound near the Boulder Patch, as assumed under the Alternative I.

CONCLUSION: The effect of Alternative III on the Boulder Patch communities is expected to be the same as under Alternative I. For Alternative III, oil spill effects on the productivity and diversity (perhaps 10%) of the Boulder Patch benthic organisms are expected to persist for 2 years. Turbidity and sedimentation effects on the growth and productivity of benthic organisms (perhaps 1-2%) of the Boulder Patch from pipeline burial and causeway construction are expected to persist for about 2 years.

(3) Pacific Region

(a) Intertidal Benthos

If Alternative III, Slow the Pace of Leasing, were selected, impacts are expected to be the same as those of Alternative I. Impacts from normal activities are not expected. The assumed oil spills are expected to result in smothering and immobilization to portions of local sandy beach populations of several species limited to the area contacted by the spill with recovery occurring within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California are expected to involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community limited to the area contacted by the spill. Recovery could be retarded in some species for a year and different assemblages within the community could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region would not cause interference with ecological relationships on a regional basis. No impacts to intertidal areas were expected in northern California, so the assumed elimination of the 30,000 bbl tanker spill of Chukchi Sea transported oil off northern California will similarly cause no change.

CONCLUSION: Adoption of Alternative III is expected to cause result in smothering and immobilization to portions of local sandy beach populations of several species limited to the area contacted by the spill with recovery occurring within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California would involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community limited to the area contacted by the spill. Recovery could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region are not expected to cause interference with ecological relationships on a regional basis. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal. There is up to a 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(b) Subtidal Benthos

If Alternative III, Slow the Pace of Leasing, were selected, most of the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. All impacts on subtidal benthic communities from both normal development and accidental causes are expected to be the same in the Southern California Planning Area as for Alternative I. Impacts from development activities on the subtidal benthos from routine operations are not expected to measurably impact subtidal organisms in the Pacific OCS Region. However, local impacts could be particularly manifest if platforms or pipelines occurred on or within 100 m (330 ft) of hard bottom features.

An assumed oil spill is expected to cause the loss or functional disruption of a few assemblages or communities at local areas within the region. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of thousands of individuals on the hard bottom community contacted causing alterations of ecological relationships with recovery requiring at least two years.

The elimination of the tanker spill in northern California will eliminate the possibility of a noticeable mortality of thousands of individuals on the hard bottom community.

CONCLUSION: Adoption of Alternative III is expected to cause noticeable mortality (except in northern California) of thousands of individuals on the hard bottom community contacted causing alterations of ecological relationships with recovery requiring at least two years of one or more benthic communities. There is up to a 62 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(4) Atlantic Region

(a) Benthic Communities

Under this scenario, routine OCS activities and associated impacts are similar to those described in Alternative I (Section IV.D.1.a(9). While no oil spills greater than or equal to 1,000 bbl are assumed under Alternative III, 10 spills of >1 to 50 bbl and 1 spill >50 to <1,000 bbl are assumed to occur. As in Alternative I, the biological stipulation would be invoked if biological resources are identified as requiring special protection.

Adoption of Alternative III would result in a decrease in routine activities by approximately 30 percent. The primary impact on benthic communities from these activities is expected to be the mortality of many sessile organisms from the discharge of drilling muds and cuttings to the seafloor (Section IV.D.1.a(9)). These effects are expected to be limited to within several hundred meters of the wellhead. At the water depths of the proposed lease blocks, recovery of affected communities could take several (3 to 5) years. Other impacts associated with routine activities can result from emplacement of pipelines and the placement and removal of anchors and platforms. Pipeline emplacement would occur in shallow water and potentially cause permanent alteration of the community surrounding the pipeline (Section IV.D.1.a). Anchor placement and removal is expected to result in minor disruptions of the sediments and benthos.

Although shallow water benthic communities are vulnerable to the effects of oil, the spills assumed under this alternative most likely would occur in the open ocean. At the depths at which the lease blocks occur, no impacts from hydrocarbons on these deepwater benthic communities are expected (Section IV.D.1.a).

In the absence of special protections, impacts to areas with unique communities or biological resources could be negatively affected under this scenario. Live bottom habitats and submarine canyons are especially vulnerable to OCS activities (Sections III.A.2.f and IV.D.1.a).

Impacts from routine activities under Alternative III would decrease by about 30 percent. The most likely impacts on benthic communities are associated with the discharge of drill muds and cuttings. These will result in alteration of the benthic community within the vicinity of the wellheads. Because of the low toxicity of drill muds and cuttings, the major impact will be the death of sessile organisms by smothering within several hundred meters of the wellhead. Recovery of affected communities is expected to occur within 1 year in shallow water but will require several (3 to 5) years in the deepwater areas of the lease blocks. The assumed oil spill (>50 to <1,000 bbl) will most likely occur in the open ocean where these spills are not expected to impact benthic communities.

CONCLUSION: Overall impacts to benthos in the Atlantic under Alternative III are expected to result only from routine activities such as anchoring the drillship or other drilling vessel, drilling wells, and installing pipelines. Population declines in the affected area are expected to result in a change in the distribution and/or abundance of the species locally. Changes in the benthic community from these activities are not expected to last more than 1 to 3 years.

(b) Submarine Canyons

Approximately 70 percent of the infrastructure and routine activities described in Alternative I (Section IV.D.1.a) are assumed under Alternative III. This decreased level of activity is expected to result in about half the potential petroleum production (40 MMbbl) relative to the Alternative I (70 MMbbl). Ten small (>1 to 50 bbl) operational oil spills and 1 spill of > 50 to <1,000 bbl are assumed. No oil spills greater than or equal to 1,000 bbl are assumed to occur. As in Alternative I, the Regional Director would invoke the biological stipulation if certain biological resources are identified as requiring special protection.

Relative to Alternative I, impacts from routine activities would be reduced by approximately 30 percent under Alternative III. Impacts on submarine canyons from routine activities are primarily associated with the discharge of drilling muds and cuttings to the seafloor (Section IV.D.1.a). In the high energy environment of the open ocean, only discharges to the seafloor are expected to affect canyon communities. The major effect of these discharges will be the burial of many sessile individuals in the vicinity of the wellhead. Transport of discharges into canyons from remote sites is also possible (Section IV.D.1.a).

Hydrocarbons from oil spills eventually could become incorporated into canyon sediments through transport and resuspension of sediments containing oil. However, because canyons are located in the open ocean where an oil spill would be widely dispersed, and because even the shallowest portions of canyons are in deep water, impacts on canyon communities from an oil spill of <50 to >1,000 bbl are not expected.

In the absence of special protection, biological resources, particularly canyon communities and live bottom habitats in the South Atlantic, could be negatively impacted by OCS activities.

CONCLUSION: Under Alternative III, impacts from OCS activities on submarine canyons are expected to result in changes in abundance and/or distribution of canyon organisms which are not expected to last longer than 1 to 3 years.

j. Impacts on Coastal Communities

(1) Gulf of Mexico Region

(a) Demography and Employment

Selection of this alternative would decrease the level of exploration, development, and production activity relative to the proposed action, as well as the associated Gulfwide employment. A total of approximately 302,400 person-years of employment (direct, indirect, and induced) are required during the 45-year life of the proposed alternative. The States of Louisiana, Mississippi, and Alabama are expected to collectively provide slightly under 79 percent of the total employment required in support of the proposal. Texas contributes over 19 percent of the Gulf Region employment impact. The least impacted state in the Gulf of Mexico Region is Florida, accounting for only two percent of the employment impact projected for the socioeconomic impact area as a result of the proposal. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Employment projected to result from oil spill clean-up activities due to the proposed alternative is approximately equivalent to 580 person-years of employment. It is expected that employment demands in support of the proposal will be met with the existing population and available labor force.

CONCLUSION: Peak levels of employment are expected to occur in the year 2000, with a total of approximately 14,675 workers involved in primary, secondary, and tertiary industries. Exploratory activities which occur during the first 17 years of the life of the proposed alternative are the main contributor to peak year employment. The greatest impact is expected in the coastal communities of Louisiana. However, it is expected that employment demands in support of the proposal will be met with the existing population and available labor force. The employment requirements for this alternative are 85 percent of those estimated for the proposal.

(b) Public Services and Community Infrastructure

The employment requirements for this alternative are 85 percent of those estimated for the proposal. Given the lower amount of potential employment in OCS oil and gas activities, a small amount of out-migration of persons from the heavily involved parishes and counties in the coastal areas of the Gulf could occur, particularly in the northcentral Gulf of Mexico (Louisiana, Mississippi, and Alabama). Impacts would be less in the northwestern Gulf (Texas), and least in the northeastern Gulf (Florida). The minimal amount of out-migration which could be associated with this proposal may result in some stresses placed on public services and community infrastructure, however, given the small difference between the alternative and the proposed action, such additional stresses are expected to be minimal.

CONCLUSION: Under Alternative III, minimal stress on public service and community infrastructure would occur.

(c) Social Patterns

Given the lower amount of potential employment in OCS oil and gas activities, a small of out-migration of persons from the heavily involved parishes and counties in the coastal areas of the Gulf could occur, particularly in the northcentral Gulf of Mexico (Louisiana, Mississippi, and Alabama). Impacts would be less in the northwestern Gulf (Texas), and least in the northeastern Gulf (Florida). The minimal amount of out-migration which could be associated with this proposal may result in some deleterious effects on family life in those individual instances of persons who leave the area and separate from the extended family. Minimal differences between employment as a result of the alternative and the proposed action would not likely result in over utilization of the fisheries resource and threats to traditional occupations as a result of exhaustion of the resource are not expected as a result of the alternative.

CONCLUSION: Under Alternative III, deleterious impacts to family life could occur in some individual case. Impacts to traditional occupations are not expected to occur.

(2) Alaska Region

(a) Demography and Employment

Except as noted below, it is assumed that all communities in Alaska that may be potentially affected by OCS activities will be experiencing normal growth or decline in both employment and population over the next 30 years. As a baseline, in any given year over the next 30 years, the employment and population in these communities are assumed to be in a state of equilibrium without rapid increases or declines. This applies individually to each of these communities and to the communities aggregated as a whole and to the State as a whole. Historic and current employment population figures are in the demography and employment part of Section III.B.3.

Oil spills could occur in any one of the planning areas. As for Alternative I, it is assumed that most employment associated with oil-spill cleanup would be in locations separated from regional centers, but the actual hiring and population increase would occur in the regional centers.

Impacts on demography and employment that are expected to result from the routine aspects of Alternative III (slow-leasing pace) would be concentrated in regional centers. Because Barrow is the regional center for both the Beaufort and Chukchi Sea sales, local employment generated by OCS activity associated with Alternative III is expected to be more than 5 percent but not more than 10 percent of projected employment for 2 to 5 years, and no sector of the local labor force is expected to change by more than 10 percent. Because Unalaska, Dutch Harbor, St. Paul, and St. George are regional centers for both the Navarin and St. George sales, the effect would spread to each of the centers. The increase is expected to be 5 to 10 percent for 2 to 5 years, and no sector of the labor force would change more than 10 percent.

For Cook Inlet, the impacts are expected to be that local employment generated by OCS activity in the peak years of OCS employment accounts for more than 1 percent but less than 5 percent of the projected level of employment for the affected area for less than 2 years, and no sector of the local labor force changes more than 10 percent.

For the Gulf of Alaska, the impacts on employment and demography are expected to be that local employment generated in regional centers by OCS activity accounts for more than 5 percent but no more than 10 percent of the projected level of employment of the affected area for 2 to 5 years, and no sector of the local labor force are expected to change more than 10 percent.

Population increases would be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole are expected to be between 1 and 5 percent for less than 2 years with no change in any sector of the State labor force greater than 10 percent. The principal cause of this impact is that employment and population directly in OCS-related activity generate secondary employment on a routine basis.

For each of the six OCS sale areas, an oil spill is expected to generate up to 15 jobs in the closest regional center for up to 1 month. The estimated spill sizes given in the scenario are 20,000 bbl for platform, 25,000 bbl for pipeline, and 30,000 bbl for tanker. Small spills of less than 1,000 bbl are described in the scenario. The size of the population increase is expected to be the same as the employment increase, because it is assumed no families would accompany these workers for such a short period of time.

CONCLUSION: The impacts of Alternative III, slow-leasing pace on demography and employment, are the same as Alternative I. For the regional centers for the Beaufort, Chukchi, Navarin, St. George, and Gulf of Alaska sales, local employment generated by OCS activity associated with Alternative III activity is expected to be more than 5 percent but not more than 10 percent of projected employment for 2 to 5 years, and no one sector of the local labor force will change by more than 10 percent. For Cook Inlet, local employment generated accounts for 1 to 5 percent for less than 2 years, and no sector of the local labor force changes more than 10 percent. Population increases are expected to be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole are expected to be between 1 and 5 percent for less than 2 years with no change in any sector of the State labor force greater than 10 percent.

For each of the six OCS sale areas, an oil spill would generate up to 15 jobs in the closest regional center for up to 1 month.

(b) Land Use

For a discussion of the baseline status of land use and oil and gas infrastructure, and the relevant parts of the action scenario, refer to the discussion contained in Alternative I.

Because Alternative III considers a sale each in the Beaufort and Chukchi Seas, certain types of basic infrastructure will be emplaced in the arctic regardless of the number of additional sales that could occur. A sale in the Chukchi and the Beaufort will require the construction of pipelines, service roads, airstrips, support bases, pump stations, and other facilities. Although the size of these facilities may be somewhat reduced due to the diminished resources, their very presence will ensure the same impacts on land use in arctic Alaska as that of Alternative I. Regarding all other sales and their impacts, there is no difference between the proposal and Alternative III, as there is no difference in resources or required infrastructure.

CONCLUSION: Alternative III would alter or disrupt land use patterns in less than one-half of 1 percent of Alaska's lands. However, the alternative could alter regional land use patterns directly and indirectly impacted by pipeline and pipeline-service-road construction for over 20 years.

(c) Transportation Networks

This alternative would lessen the flow of material and people on transportation systems serving the Arctic relative to Alternative I but would not change the number or type of emplaced petroleum-related facilities from those forecast for the proposal. With one sale each forecast to occur in the Chukchi and Beaufort Seas, basic production infrastructure such as support bases, airstrips, pipelines, pump stations, and service roads would be emplaced. However, the level of use and the size of some of these facilities serving the Chukchi and Beaufort Sea fields would be reduced from that of the proposal due to the fact that two less sales would occur in arctic Alaska. Passenger and material volumes on road, air, and marine systems serving OCS-related petroleum development in the Beaufort and Chukchi Seas should fall by at least 40 percent from that projected for the proposal. In all other areas of Alaska, the sale schedule and estimated resources do not vary from those of the proposal. Accordingly, there should be no change in impacts on transportation systems in subarctic Alaska for this alternative from those of the proposal. Regarding Valdez oil-tanker traffic, ship departures from the Valdez terminal should decline to between 700 and 800 per year during the first decade of the next century moving rapidly downward with the decline of Prudhoe production.

CONCLUSION: Impacts to transportation networks from Alternative III are expected to be the same as the proposed action for all areas other than the Beaufort and Chukchi Seas. In those areas, impacts due to passenger and freight movement are expected to be reduced by as much as 40 percent.

(d) Sociocultural Systems

The direct social consequences of the slow-leasing-pace alternative would be felt primarily among the communities of the North Slope Borough (NSB), given that the alternative has half the number of sales in the Arctic than does the proposal.

The impact-producing factors (IPF's) that could affect sociocultural systems also are the same as for Alternative I, including the introduction of changes in industrial activities, changes in local population and employment, and effects on subsistence harvests and networks.

As in Alternative I, the changes in industrial activities introduced by these IPF's would be community-specific and, in most cases, would not represent the introduction of industrial activities for the first time. Most supply and support bases would be located at or near existing industrial infrastructure such as airports and harbors. Industrial enclaves are assumed to be used in areas without existing industrial infrastructure.

Changes in the number and characteristics of population and employment associated with industrial growth in the slow-leasing-pace alternative would likewise be community-specific and would be centered in Barrow directly and indirectly among the other communities of the NSB. Reducing by half the number of lease sales in the Arctic would not only reduce the population and employment growth of Barrow and other NSB communities but would also reduce by half the number of times that public officials would entrain northward to carry out the processes involved in preparing for a lease sale. These public-participation processes ignite anew the fears of resource destruction, and their reduction would tend to reduce the stresses on Inupiat social systems, at least for the time they are not being carried out. Otherwise, such reduced increases in population and employment should be absorbed in the community without seriously disrupting existing institutions or values, although the community may be stressed by the introduction of additional oil-related people. Elsewhere in Alaska, the effects of additional population and employment in the slow-leasing-pace alternative on sociocultural systems would be the same as Alternative I, because the given conditions of future OCS activities are the same as Alternative I.

Impacts on subsistence are probably the most powerful means for insulting existing social systems in Alaska and causing impacts on sociocultural systems within specific and regional (such as the North Slope Inupiat) communities. Impacts on subsistence in the slow-leasing-pace alternative are expected to be centered predominantly among the arctic communities of the NSB as a result of the two proposed Chukchi and Beaufort Sea sales (see analysis of effects on subsistence in Alaska). One spill of 1,000 bbl or more is assumed to occur in the Arctic under this alternative compared to 4 such spills for the proposal. The greatly reduced number of such spills occurring in the Arctic suggests that effects on subsistence in the Arctic likewise would be less because of reduced frequency and possible magnitude of spill events as effects-causing agents. However, the loss or perceived loss of any important subsistence resources would seriously affect the relative balance of subsistence practices not only in terms of quantities of protein used during the annual harvest cycle but also the balance of relationships in social and political obligations. Because of the one assumed spill, one or more important subsistence resource would become unavailable, undesirable for use, or available but in greatly reduced numbers for 1 to 2 years during the (30-year) life of the proposed leases in the Arctic.

Disruptions of Inupiat subsistence harvests (especially that of the bowhead whale, which is an important species to the Inupiat culture) would disrupt subsistence-task groups, crew structures, and sharing networks among kinship groups and within and among communities. An increase in social stress would be expected in the communities affected, producing a sense of loss and dislocation expressed in rising rates of substance abuse, violence, suicide, accidental deaths, mental illness, and other social problems. The growth of such problems is indicative of negative sociocultural effects, and the stress and anxiety caused by the disruptions may last for a longer period of time than the subsistence loss itself.

Indirect effects from the two proposed Arctic sales also would be expected on Gulf of Alaska communities and elsewhere as a result of the tankering of Arctic oil from the southern terminus of the TAPS in Valdez in combination with offshore Gulf activities. Effects on subsistence in the Gulf region as a result of three tanker spills of equal to or greater than 1,000 bbl would limit the availability or accessibility of at least one important subsistence resource for a period not exceeding 1 year. Similar effects would be expected on Kodiak Island and on the Alaska Peninsula as a result of tankering of Beaufort and Chukchi Sea oil as well as Gulf of Alaska and Cook Inlet oil. Disruptions to the subsistence systems would not be expected to last more than 1 year, and their effects to the sharing networks and subsistence task groups likely would be small and intermittent. On the other hand, tensions and anxieties caused by the disruptions may last for a longer period of time.

Elsewhere in Alaska, the potential effects-causing agents relative to the slow-leasing-pace alternative are the same as Alternative I, because the alternative contains no changes beyond the number of sales in the Arctic. This would produce the same effects on sociocultural systems outside the Arctic as Alternative I.

Effects on sociocultural systems from tanker spills of arctic crude of equal to or greater than 1,000 bbl in the Washington/Oregon area and southern California would be the same as Alternative I. However, sociocultural systems would be unaffected in northern California from arctic crude tanker spills, because no tanker spills are assumed for northern California in this alternative.

The effects of added measures of protection also would be the same as for Alternative I.

CONCLUSION: Based on the scenario assumptions, Alternative III is expected to contribute to the increasing urbanization of the North Slope Borough, and Barrow in particular, and increase the need for wage income. These effects will be somewhat less than the proposal because fewer sales would occur in the Arctic under Alternative III. Dysfunctional social effects, such as domestic violence and substance abuse, are expected to be sustained and perhaps increase, but to a lesser extent than the proposal. Effects on sociocultural systems are expected to be most unsettling in areas that are least urbanized. The effects on sociocultural systems in subarctic areas of Alaska are expected to be the same as the proposal.

(3) Pacific Region

(a) Demography and Employment

Adoption of Alternative III would reduce the number of lease sales proposed for the Alaska OCS Region and as a result, a tanker spill off northern California would be eliminated. All other routine activities and accidental events assumed to occur in the Pacific OCS Region under Alternative I scenario remain the same. Even with a reduction in the total number of potential tanker spills, estimated impacts to employment and population would not change because the spill was assumed to occur offshore northern California, more than 80 km (50 miles) offshore and was not expected to contact the coast.

CONCLUSION: Based on the scenario for Alternative III, the expected impacts on employment and population would be the same as under Alternative I. Employment and population impacts would be less than one percent of the general growth.

(b) Land Use

Adoption of Alternative III would reduce the number of lease sales proposed for the Alaska OCS Region and as a result, a tanker oil spill off northern California would be eliminated. All other routine activities and accidental events assumed to occur in the Pacific OCS Region under Alternative I scenario remain the same.

The expected impacts on land use would be the same as under Alternative I. No changes to land use are expected to result directly from the proposal since no new onshore facilities are expected to be constructed. But, housing needs for the new resident population could result in the conversion of about 230 acres of open space land for residential use.

CONCLUSION: As a result of Alternative III, no new onshore facilities are expected to be constructed. Therefore, no changes to land use are expected. However, as in Alternative I, the housing needs of the estimated 2,300 new residents could result in the conversion of about 230 acres of open space land for residential use. Impacts to land use as a result are expected to be less than one percent.

(c) Vessel Traffic and Ports

Adoption of Alternative III would reduce the number of lease sales proposed for the Alaska OCS Region and as a result, a tanker oil spill off northern California would be eliminated. All other routine activities and accidental events assumed to occur in the Pacific Region under Alternative I scenario remain the same.

In the Alternative I proposal, temporary impacts of up to two months to marine vessels, such as rerouting and/or preclusion from leaving port were expected as a result of the hypothesized oil spills, which included a pipeline spill in southern California, tanker spills off the coast of Washington, northern California, and southern California.

CONCLUSION: Impacts due to Alternative III are expected to remain the same as the proposal. The assumption that ship traffic rerouting would be required around the spill for the duration of at-sea-cleanup activities (which could last from 30 to 60 days) would be eliminated. However, the overall regional risk of tanker spills would not be eliminated.

(d) Public Services

Adoption of Alternative III would reduce the number of lease sales proposed for the Alaska OCS Region and as a result, a tanker oil spill off northern California would be eliminated. All other routine activities and accidental events assumed to occur in the Pacific Region under Alternative I scenario remain the same.

The expected impacts on water supply would be the same as under Alternative I. The activities associated with Alternative I scenario are expected to result in an increase in water demand of about 10 million gallons of potable water in the peak year 2007 and about 47 million gallons of non-potable water.

CONCLUSION: The activities associated with Alternative III are the same as Alternative I and are expected to result in an increase in water demand of about 10 million gallons of potable water in the peak year 2007 and about 47 million gallons of non-potable water. This increase in demand would put more pressure on already limited existing water supplies.

(4) Atlantic Region

(a) Demography and Employment

The scenario for Alternative III assumes 10 fewer exploratory wells than Alternative I, resulting in a total of 25. Other assumptions in this scenario result in a reduction in the level of 29 development and production wells and 2 production platform for a total of 79 and 4, respectively. Other infrastructure components of Alternative III assumed to support offshore operations remain the same as in Alternative I. Therefore, 2 support bases, 3 gas pipelines, and 2 gas processing plants are assumed to be needed for production of hydrocarbon resources under Alternative III. A description of the potential impacts expected from these assumptions is given in Section IV.D.1.a(10). Oil spills greater than or equal to 1,000 bbl are not assumed under this scenario.

The reduction in the number of exploration and development wells and production platforms from Alternative I will reduce the potential for offshore operations to generate employment for coastal residents. However, as discussed in Section IV.D.1.a(10), the absence of an existing offshore drilling industry in the Atlantic coastal States limits the number of jobs that are expected to be available to coastal residents. This would result in the majority of workers on offshore drilling rigs and platforms coming from outside the area. Therefore, the impact factors effecting demography and employment from offshore drilling operations in Alternative III is the same as in Alternative I. Since the number of support bases, gas pipelines, and gas processing plants in the Alternative III scenario are the same as those assumed for Alternative I, the impact of these facilities on demography and employment is expected to remain the same.

In summary, under Alternative III, exploration for oil and gas will offer few employment opportunities for coastal residents. Because of their longer period of operation, development and production of discovered hydrocarbon resources under the scenario for Alternative III are expected to increase employment in areas surrounding permanent support bases. However, the increase in the number of jobs is not expected to add significantly to the existing economy. Increases in population as a result of Alternative III, compared to the already high growth rates of coastal counties, are expected to be small.

CONCLUSION: Under Alternative III, the absence of an offshore drilling industry limits employment opportunities for local residents. There is the potential for an increase in the number of jobs available to coastal residents as a result of OCS activities under Alternative III. This increase, however, is not expected to be significant compared to the number of jobs already available in coastal economies.

(b) Land Use

The scenario for Alternative III assumes 10 fewer exploratory wells than Alternative I, resulting in a total of 25. Other assumptions in this scenario result in a reduction from base case levels of 29 development and production wells and 2 production platform for a total of 79 and 4, respectively. Other infrastructure components of the scenario assumed to be needed to support offshore operations under Alternative III remain the same as in Alternative I. Therefore, 2 support bases, 3 gas pipelines, and 2 gas processing plants are assumed to be needed for production of hydrocarbon resources under Alternative III. A description of the potential impacts expected from these assumptions is given in Section IV.D.1.a(10). An oil spill greater than or equal to 1,000 bbl is not assumed under this scenario.

Since the number of onshore facilities remains the same for Alternative III as for Alternative I scenario, the amount of land that will be affected is expected to remain the same. Therefore, under Alternative III, there will be no change in the impacts expected from the construction of onshore facilities (see Section IV.D.1.a(10)).

In summary, creation of the infrastructure assumed under Alternative III is expected to require the expansion of existing facilities and convert undeveloped land to the industrial use category. However, existing ports in the region can handle the acreage needs of OCS support bases, thereby avoiding discernible impacts on coastal land use. Additionally, State coastal management programs and Governmental regulations and permit requirements will direct pipeline landfalls and development of gas processing facilities to appropriate areas.

CONCLUSION: Under the scenario for Alternative III, the acreage of the industrial/urban class of land use in coastal communities is expected to increase by 46 to 120 hectares (140 to 300 ac). However, areas exist within the potentially affected States that are already designated for industrial development and could accommodate the possible siting of facilities related to OCS operations under this alternative.

(c) Vessel Traffic and Ports

The scenario for Alternative III assumes 10 fewer exploratory wells than Alternative I, resulting in a total of 25. Other assumptions in this scenario result in a reduction from base case levels of 29 development and production wells and 2 production platform for a total of 79 and 4, respectively. Other infrastructure components of the scenario assumed to be needed to support offshore operations under Alternative III remain the same as in Alternative I. Therefore, 2 support bases, 3 gas pipelines, and 2 gas processing plants are assumed to be needed for production of hydrocarbon resources under Alternative III. A description of the potential impacts expected from these assumptions is given in Section IV.D.1.a(10). An oil spill greater than or equal to 1,000 bbl is not assumed to occur under this scenario.

The number of support bases assumed under Alternative III is the same as for Alternative I. Therefore, under Alternative III there will be no change from Alternative I in the impacts expected from the construction of onshore facilities (see Section IV.D.1.a(10)). However, the determining factor in the amount of vessel activity at the support bases is the number of wells drilled and the timing of the drilling operations. The total number of wells drilled for Alternative III is reduced by 14 for a total of 129. These wells are assumed to be drilled between 1995 and 2006; the same length of time as Alternative I drilling program. Therefore, under Alternative III, there is expected to be a very slight reduction in vessel traffic associated with OCS operations compared to Alternative I scenario. Associated with this reduction in vessel activity is an expected reduction in the potential for conflict with commercial and recreational fishing. Additionally, the potential for small fuel spills occurring will decrease.

As discussed in Alternative I, existing traffic routing measures and safety regulations can manage the drilling activity assumed under Alternative III. Enforcement of marine safety laws and oil spill contingency plans will combine to prevent appreciable impacts from small fuel spills (see Section IV.D.1.a(10)).

CONCLUSION: Regulations enforced by the U.S. Coast Guard are adequate for the safe management of vessel traffic. Existing port facilities can accommodate volume of vessel traffic assumed under Alternative III. Therefore, no measurable change to the Atlantic coast vessel traffic is expected.

k. Impacts on Fisheries

(1) Gulf of Mexico Region

(a) Commercial Fishing

A number of routine events such as production platform emplacement may adversely affect commercial fishing. It is estimated that new offshore platforms resulting from the proposal will remove approximately 864 ha (2,160 ac) of trawling space from commercial fishing, representing less than 0.01 percent economic loss to the commercial fishing of shrimp and sciaenid groundfish for no more than one fishing season.

Accidental events such as underwater OCS obstructions and oil spills may adversely affect fish resources. It is assumed that 4,159 km (2,582 miles) of offshore pipeline will result from the proposed action. Underwater obstructions will cause a 0.01 percent or less economic loss to the commercial fishing of menhaden, shrimp, and sciaenids for no more than one fishing season. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana, Mississippi, and Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Less than five small OCS-related spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. The pipeline spill will contact and affect 16 ha of estuaries. The small oil spills will contact and affect no more than 100 ha of estuaries and fish nurseries for less than one fishing season. Both lethal and sublethal effects on commercial fisheries resources and depression of commercial fishing activities will occur.

CONCLUSION: As a result of this alternative, a 0.01-0.1 percent economic loss to commercial fisheries of estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters is expected to occur for one to two fishing seasons (1-2 years). The principal cause of impacts is spilled oil, and the probability of their occurrence (10,000 bbl or greater) ranges up to 18 percent.

(b) Recreational Fishing

This alternative will lead to the installation of new offshore gas and oil production platforms which will function as very large artificial reefs attracting sport fish and fishermen. Selection of this alternative over the proposal would result in a 17 percent reduction in the number of platform installations estimated under the proposal, Gulfwide. In the northwestern Gulf this reduction would be approximately 10 percent, in the northcentral Gulf 18 percent, and in the northeastern Gulf 50 percent. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. The larger size class oil spills will temporarily discourage offshore fishing and lead to a loss of fishing activity and a decline in the sale of fishing equipment, supplies and services within the coastal community directly impacted. The lack of fishing activity and the loss of sales of fishing equipment, supplies and services caused by oil pollution will not extend beyond the community impacted or the days or weeks it takes to clean up the spill.

CONCLUSION: The marine recreational fishing industry is expected to continue its growth and expansion in the Gulf of Mexico in direct association with continued and expanded economic growth in general, and gas and oil leasing in particular. Many of the future offshore fishing trips in the northern Gulf will extend the focus of specific fishing efforts in direct proximity to the new gas and oil platforms expected to result from the proposal. Oil spills will disrupt fishing activities in the offshore areas directly impacted, and can lead to a decline in the sale of fishing equipment, supplies, and services for up to one fishing season when large quantities of oil pollution come ashore in a coastal fishing community.

(2) Alaska Region

COMMERCIAL FISHING: The routine elements of the scenario for Alternative III that may affect commercial fishing are as follows: OCS-vessel traffic that could conflict with commercial-fishing traffic, especially in areas such as enclosed bays; wells, platforms, and offshore pipelines; and onshore marine bases that are also used by the commercial-fishing industry. The number of wells and platforms are less for Alternative III (6 platforms, 230 wells) than Alternative I (10 platforms, 397 wells) for the Beaufort Sea and the Chukchi Sea sales but the same for the other sales, as described in the scenario. The way these OCS elements may affect commercial fishing is described in Alternative I.

Oil spills, as described in the scenario, could affect commercial fisheries. Oil spills could come from platforms, offshore pipelines, or tankers carrying oil. The number of spills in Alternative III is less in the Beaufort and Chukchi areas (1 as compared to 4 in Alternative I) but the same in other areas.

Potential adverse effects on the commercial-fishing industry include: (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; (3) loss or damage to fishing vessels through collisions with oil-industry vessels; (4) competition for support services, infrastructure, materials, and labor; and (5) competition for space onshore. Further details are described in Alternative I.

Oil spills could damage the commercial fisheries by gear fouling; preemption or closure of fishing areas; direct loss of catch; and contamination or tainting of harvest. The number of spills are less for Alternative III (1) than Alternative I (4) in the Beaufort Sea and Chukchi Sea sales but the same for the other sales, as described in the scenario. The estimated spill sizes given in the scenario are 20,000 bbl for platform, 25,000 bbl for pipeline, and 30,000 bbl for tanker. Small spills of less than 1,000 bbl are described in the scenario. Impacts on water quality from oil spills, which are analyzed in the water-quality section, are used in analyzing impacts on commercial fish. The conclusion of that section is that water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for about 30 days. Further details are described in Alternative I.

For each of the sale areas with commercial fishing, it is expected the impact of Alternative III on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear in the range of up to 5 percent and loss of secondary employment in the range of up to 5 percent resulting from (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; and/or (3) loss or damage to fishing vessels through collisions with oil-industry vessels. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor as a result of increased competition. Costs to commercial fishermen are expected to increase no more than 10 percent for space onshore as a result of increased competition. These impacts are expected to last for as many seasons as there is OCS activity.

Chukchi Sea is the only area without commercial-fishing activity. For each of the planning areas with commercial fishing, it is expected that oil spills could damage the commercial fisheries by gear fouling, preemption or closure of fishing areas, direct loss of catch, and contamination or tainting of harvest. Commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days the commercial fisheries would have a up to 5 percent loss of catch, and up to 5 percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil could be up to 5 percent.

CONCLUSION: The impacts for Alternative III are the same as for Alternative I. For each of the sale areas with commercial fishing, it is expected the impact of the proposal on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear in the range of up to 5 percent and loss of secondary employment in the range of up to 5 percent. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor and no more than 10 percent for space onshore. These impacts are expected to last for as many seasons as there is OCS activity.

As a result of the assumed oil spill, commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days, the commercial fisheries are expected to have up to 5 percent loss of catch and up to 5 percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil is expected to be up to 5 percent.

(3) Pacific Region

(a) Commercial Fisheries

If Alternative III, Slow the Pace of Leasing, were selected, the most of the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. All impacts on commercial fishery resources from both normal development and accidental causes are expected to be about the same in the Southern California Planning Area and Washington as for Alternative I. Impacts to commercial fisheries due to routine activities (installation and operation of offshore manmade structures and onshore facilities, vessel traffic, effluents and discharges) and small (<1,000 bbl) oil spills are expected to involve inconveniences lasting for the life of the platform of 35 years with little or no discernible economic loss. The assumed oil spills are expected to result in high economic losses ranging from 20 to 30 percent lasting for two seasons and more than 10 percent unemployment of the fixed-gear fishermen and financial losses of 10 to 20 percent of economically dependent businesses in the Santa Barbara and northern Washington regions.

The elimination of the tanker spill in northern California will eliminate tainted fisheries resources or contaminated fishing gear contacted by the oil, where fishermen could be expected to sustain economic losses for about one month or as long as it takes to clean their gear.

CONCLUSION: Adoption of Alternative III would result in the elimination of tainted fisheries resources or contaminated fishing gear contacted by the oil offshore northern California, where fishermen could be expected to sustain economic losses for about one month or as long as it takes to clean their gear .

(b) Recreational Fisheries

If Alternative III, Slow the Pace of Leasing, were selected, most of the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. Routine activities associated with the proposal (installation and operation of manmade offshore structures, increased vessel traffic, and drilling discharges) are expected to result in economically indiscernible minor inconveniences to marine recreational fishing activities within the area lasting for a season or less for drilling discharges and for the 35 years life of the project from structures and vessel traffic. While numerous, very small oil spills (usually <1 bbl) are expected to occur, they are unlikely to have any impact on recreational fishing. The assumed oil spills contacting a harbor used by sport fishermen is expected to result in local economic losses of 10 to 20 percent over a period of approximately a month, or the length of time needed for spilled oil to be cleaned up or dissipated by wind and waves. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced by the proposal, fisheries resources available to sportfishermen will be unchanged.

Elimination of the tanker spill in northern California will eliminate the most noticeable impacting agent to marine recreational fishing as spills tend to preclude all sportfishing in the affected area until cleanup or dispersion of oil occurs. The eliminated large spill may have resulted in the loss of fish and invertebrate resources (less than 10 percent), decreased resource accessibility, and possibly reduced desirability of fish and invertebrates through tainting.

CONCLUSION: Adoption of Alternative III would eliminate a less than 10 percent loss of fish and invertebrate resources, decreased resource accessibility, and possibly reduced desirability of fish and invertebrates through tainting due to the assumed tanker spill off northern California.

(4) Atlantic Region

(a) Commercial Fishing

Under this scenario, routine OCS activities and associated impacts are similar to those described in Alternative I (Section IV.D.1.a). While no spills of 1,000 bbl or greater are assumed under Alternative III, 10 small (>1 to 50 bbl) and 1 (>50 to <1,000) oil spill are assumed to occur. As in Alternative I, biological resources may be identified as requiring special protection.

Approximately 70 percent of the infrastructure and routine activities described in Alternative I (Section IV.D.1.a) are assumed under Alternative III. The 30 percent decrease in the level of activity is expected to result in about half the potential petroleum production (40 MMbbl) relative to Alternative I (77 Mmbbl). The primary impacts on commercial fisheries under this scenario are expected to be spatial conflicts between fishermen and the petroleum industry and gear loss or damage. As in Alternative I (Section IV.D.1.a(11)), spatial conflicts are expected to arise at the dock/shipyard and on the fishing grounds. Spatial conflicts on the fishing grounds may be minimized by publishing the proposed activities in *Notice to Mariners* and by oil company supervisors and vessel operators completing a Fisheries Training Program. Bottom fishing gear is most vulnerable to damage by bottom-founded structures, drill rig anchors, seismic surveying equipment, or pipelines during the production phase. Gear losses to fishermen may be compensated through the Fishermen's Contingency Fund. Other impacts on commercial fisheries associated with routine OCS activities include sediment disturbance during emplacement of platforms and pipelines, noise, and the discharge or drilling muds and cuttings, and wastewater. Although effects from these activities on fish resources will be similar to those described in Alternative I (Section IV.D.1.a(11)), the level of activity is assumed to decrease by about 30 percent. Therefore, the extent of the impacts on commercial fisheries under Alternative III is expected to decrease relative to Alternative I.

The small operational spills and 1 oil spill (>50 to <1,000 bbl) assumed under this alternative most likely would occur in the open ocean. The release of hydrocarbons into this high energy environment is not expected to result in changes to commercial fisheries which could be detected against natural variation (Section IV.D.1.a).

In the absence of special protections, impacts to areas with unique communities or biological resources could be negatively affected under this scenario. Especially vulnerable to OCS activities are the live bottom habitats of the South Atlantic which contain commercial fish resources (Sections III.D.2.f and IV.D.1.a).

Relative to Alternative I, impacts from routine activities under Alternative III would decrease. The most likely impacts on commercial fisheries would be spatial exclusion on the fishing grounds and loss or damage of fishing gear. Although this would cost a small number of fishermen money and time, there would be no impact on the commercial fishing industry as a whole. Emplacement of platforms and pipelines and the discharge of muds and cuttings are also expected to impact commercial fisheries through increased turbidity levels and long-term alteration of the substrate. Impacts from small spills are not expected to result in changes in the commercial fisheries which could be distinguished from natural variation.

CONCLUSION: Adoption of this alternative is not expected to result in measurable economic losses to commercial fishing which would last more than one to two seasons. No loss in secondary employment is expected.

(b) Recreational Fishing

Relative to Alternative I (Section IV.D.1.a), adoption of Alternative III would result in a decrease in routine activities by approximately 30 percent. Routine activities would be similar to those outlined above and described in detail in Alternative I (Section IV.D.1.a). Under Alternative III, 10 small (>1 to <50 bbl) operational oil spills and 1 spill >50 to <1,000 bbl are assumed. No oil spills greater than or equal to 1,000 bbl are assumed to occur. As in Alternative I, the Regional Director may identify certain biological resources as requiring special protection.

Because most recreational fisheries occur near shore, few spatial conflicts between recreational fishermen and the petroleum industry are anticipated. The major impact from routine OCS activities on fish resources is expected to result from pipeline emplacement and drilling discharges. Both pipeline emplacement and the near-surface discharge of muds and cuttings would result in localized, temporary increases in turbidity levels, but these are not expected to result in measurable changes in recreational fish resources. Pipeline emplacement and the discharge of muds and cuttings to the seafloor are expected to locally bury sessile organisms in proximity to these activities and result in long-term alteration of the sediments. Recolonization of shallow water communities, which constitute a direct or indirect food source for recreational fish species, is expected to occur within 1 year but require several (3 to 5) years in the deepwater lease blocks.

Small operational spills most likely would occur in the open ocean environment where strong currents are expected to disperse the hydrocarbons. Although individual organisms may suffer mortality, no measurable changes in recreational fisheries overall are anticipated.

In the absence of special protection, biological resources, particularly live bottom habitats in the South Atlantic, could be negatively impacted by OCS activities. Many of these areas contain important concentrations of recreational fishes.

If Alternative III is adopted, impacts to recreational fisheries would result primarily from pipeline emplacement and the discharge of drill muds and cuttings. Hydrocarbons, most likely released into the open ocean environment, are not expected to result in measurable changes in the recreational fisheries.

CONCLUSION: Under Alternative III, impacts from OCS activities on recreational fisheries are not expected to result in any measurable economic losses.

l. Impacts on Subsistence

(1) Alaska Region

The impact-producing factors also are the same as for Alternative I, including oil spills, noise and traffic disturbance, or disturbance from construction activities associated with pipelines and shore-base facilities.

The number of pipelines, pipeline landfalls, and shore bases are assumed the same as for Alternative I, although the capacity of these facilities should be reduced due to the reduced number of sales in the slow-leasing-pace alternative. Although this difference in sizing would exist, the effects on subsistence from constructing these facilities should be the same as for Alternative I because the types of effects would remain the same.

The primary differences between the slow-leasing-pace alternative and Alternative I of the proposal result from cutting the number of sales in half in the Arctic. Having only one sale each in the Beaufort and Chukchi Sea areas reduces the chance of a platform spill of equal to or greater than 1,000 bbl occurring in the Arctic to zero, and reduces the possible number of pipeline spills of such magnitude from three in Alternative I to one in the alternative. This means that the number of oil spills in the Arctic of equal to or greater than 1,000 bbl would be reduced from four to one. Although the number of tanker spills of such magnitude are likewise reduced from four to three, effects on subsistence in the Arctic are unchanged, because the effects of such spills occur outside the Arctic—within the tanker-shipping lanes south of the Port of Valdez. Although the chance of spills occurring of equal to or greater than 1,000 bbl is still relatively high, the greatly reduced number of such spills occurring in the Arctic suggests that effects on subsistence in the Arctic would be likewise reduced as a function of reduced frequency and possible magnitude of spill events as effects-causing agents. However, the loss or perceived loss of any important subsistence resources would seriously affect the relative balance of subsistence practices not only in terms of quantities of protein used during the annual harvest cycle but also the balance of relationships in social and political obligations. Although the number of arctic spills is reduced, the high probability of occurrence of spills suggests that one or more important subsistence resource would become unavailable, undesirable for use, or available only in greatly reduced numbers for 1 to 2 years during the life of the proposed leases in the Arctic.

Elsewhere in Alaska, the potential effects-causing agents relative to the slow-leasing-pace alternative are the same as Alternative I for the proposal, because the alternative contains no changes beyond the number of sales in the Arctic. This would produce the same effects on subsistence outside the Arctic as Alternative I.

Effects on subsistence from tanker spills of arctic crude of equal to or greater than 1,000 bbl in the Washington/Oregon area and southern California are the same as Alternative I. Subsistence is unaffected in northern California from arctic crude tanker spills, because no tanker spills are assumed for northern California in this alternative.

CONCLUSION: Impacts on subsistence in the slow-leasing-pace alternative are expected to be reduced in the Arctic because the number of assumed oil spills in the Arctic is reduced from four to one. The greatly reduced number of such spills occurring in the Arctic suggests that effects on subsistence in the Arctic likewise would be reduced as a function of reduced frequency and possible magnitude of spill events as effects-causing agents. However, the loss or perceived loss of any important subsistence resources would seriously affect the relative balance of subsistence practices not only in terms of quantities of protein used during the annual harvest cycle but also the balance of relationships in social and political obligations.

Indirect effects on subsistence from tankering arctic oil and effects elsewhere due to other proposed sales would be the same as Alternative I, because little or no difference exists here between the alternative and Alternative I.

(2) Pacific Region

Adoption of Alternative III reduces the number of OCS lease sales proposed in the Alaska Region. As a consequence of Alternative III, one less tanker spill is hypothesized to occur along the west coast of the United States than was estimated in Alternative I. Even with a reduction in the total number of potential tanker oil spills, estimated impacts to subsistence are unchanged because the spill was assumed to occur offshore northern California, more than 80 km (50 miles) offshore. It was not expected to contact the coast or affect subsistence activities. Therefore, impacts to subsistence resources in Alternative III are identical to those identified for Alternative I (Section IV.D.1.a(12)).

Routine activities associated with the proposed action in the Pacific Region, including the construction of subsea pipelines and platforms, the drilling of exploratory and production wells, and drill rig and platform removal, will occur at least 3 miles from shore away from intertidal gathering areas. Impacts to intertidal gathering areas are not expected.

Impacts to subsistence resources from accidental pipeline spills or spills of Alaskan oil transported by tankers greater than 1,000 bbl would depend upon the location and season. The greatest effects to subsistence could be expected if the spill contacted rocky intertidal areas near population centers. This could have the effect of reducing the availability or desirability of one or more important species in some of the local areas off the coast, for up to a year.

CONCLUSION: Adoption of Alternative III is expected to result in a reduction in the availability or desirability of one or more subsistence resources for up to a year. Routine exploratory and development activities associated with Alternative III are not expected to occur within any intertidal gathering areas. Therefore, no impacts to onshore intertidal gathering areas are expected. The major impacting agent would be from accidental oil spills. The probability of one or more pipeline spills occurring off southern California is 34 percent.

m. Impacts on Archaeological Resources

(1) Gulf of Mexico Region

The greatest potential impact to an historic archaeological resource as a result of the proposed action would result from a contact between an OCS offshore activity (platform installation, drilling rig emplacement, dredging, and pipeline projects) and an historic shipwreck.

Most other activities associated with this alternative are expected to have little to no impacts on historic archaeological resources. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. Historic cultural resources, therefore, will not be affected by these activities. Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. The chance of contact from an oil spill associated with this alternative on a historic site is very small. Furthermore, the impact from an oil-spill contact on an historic coastal site, such as a fort or lighthouse, would be visual due to oil contamination. These impacts would be temporary (lasting up to weeks) and reversible.

An OCS activity could contact a shipwreck because of incomplete knowledge on the location of shipwrecks in the Gulf. Such an event could result in the disturbance or destruction of unique or significant historic archaeological information. However, it is estimated that magnetometer surveys at 50 m linespacing will be 90 percent effective at locating historic shipwrecks within high probability areas. Other factors associated with this alternative are not expected to affect historic archaeological resources.

PREHISTORIC: Several impact-producing factors may threaten the prehistoric archaeological resources of the northwestern Gulf. An impact could result from a contact between an OCS activity (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) and a prehistoric site located on the continental shelf. The archaeological surveys and archaeological clearance of sites that are required prior to an operator beginning oil and gas activities in a lease block are estimated to be 90 percent effective at identifying possible prehistoric sites. Since the survey and clearance provide a significant reduction in the potential for a damaging interaction between an impact-producing factor and a prehistoric site, there is little chance for damaging interaction between an impact producing factor and an archaeological site or resource.

Onshore development resulting from this alternative could result in the direct physical contact between new facility construction, and pipeline trenching. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. There is little to no expected impact from these factors.

Three oil spills greater than or equal to 1,000 bbl would occur from program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas.

Should an oil spill contact a coastal prehistoric site, the potential for dating the site using radiocarbon methods could be destroyed. Oil spill cleanup operations could physically impact coastal prehistoric sites. Previously unrecorded sites could also experience an impact from oil-spill cleanup operations. The probability of a spill greater than or equal to 1,000 bbl occurring and contacting a coastal prehistoric site in western Louisiana and eastern Texas has been assumed to be 20 percent. Should such contact occur unique or significant archaeological information could be lost.

CONCLUSION: As a result of this alternative, it is expected that a historic or prehistoric archaeological site containing significant but not unique information would be disturbed to an extent that the site loses at least one but not all the physical features which would yield scientific information.

(2) Alaska Region

It is assumed in this alternative that there will be 67 exploration and development wells and 373 development and production wells over the entire Alaskan OCS. This results in an assumption of one pipeline spill in the Chukchi Sea, none in the Beaufort Sea, two tanker spills in the Bering Sea, and two in the Gulf of Alaska.

A slowed leasing pace will assume that there will be less exploration and even less development. As a result, there will be fewer oil spills than in Alternative I. These spills would entail some cleanup. Such activity in exploration, development, or oil-spill cleanup can disturb archaeological resources. For example, 26 archaeological sites were damaged by oil and activity during cleanup of the *Exxon Valdez* oil spill. Although impacts on other Alaskan areas remain the same as Alternative I with this alternative, the Chukchi Sea area is expected to be the most protected by this alternative because of the lower number of resources and the lower number of assumed spills. This cleanup activity would not affect offshore resources but is expected to affect onshore resources by the loss of small amounts of information. This information is deemed replaceable by other similar archaeological resources in other locations. The losses are expected to be minimized by the in place protective processes of the archaeological stipulation.

CONCLUSION: Based on the scenario for Alternative III, it is expected that some impact may occur to coastal historic and prehistoric archaeological resources from accidental spills. Although it is not possible to predict the precise number or types of sites that could be affected, it is expected that a small amount of significant information will be lost.

(3) Pacific Region

Adoption of Alternative III reduces the number of OCS lease sales proposed in the Alaska Region. As a consequence of Alternative III, one less tanker spill is hypothesized to occur along the west coast of the United States than was estimated in Alternative I. Even with a reduction in the total number of potential tanker oil spills, estimated impacts to archaeological resources are unchanged because the spill was assumed to occur offshore northern California, more than 80 km (50 miles) offshore. It was not expected to contact the coast or affect any archaeological resources. Therefore, impacts to archaeological resources in Alternative III are identical to those identified for Alternative I (Section IV.D.1.a(13)).

Archaeological resources could be disturbed as a result of bottom disturbing activities, such as drilling exploratory wells, installation of platforms, or installation of offshore pipelines. However, prior to the initiation of such operations, remote sensing surveys are conducted at prospective well and platform sites, and along pipeline corridors. The results of these surveys are used to identify and avoid any anomalies that may represent archaeological resources. Any site that is discovered during operations will be reported, and the operator will be required to follow directions from MMS to protect the resource.

CONCLUSION: Routine OCS activities assumed for Alternative III are expected to have negligible impacts on archaeological resources in the Pacific Region. Assuming a spill and contact with the shoreline, the viewshed of onshore prehistoric or historical sites would be temporarily degraded during the spill and associated cleanup activities. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal.

(4) Atlantic Region

PREHISTORIC RESOURCES: Possible impacts to the prehistoric sites could arise from bottom-disturbing activities. The routine activities under Alternative III for the Atlantic that could impact these sites are the laying of pipelines inside the 30-m isobath off most of the Atlantic coast, or inside the 18-m isobath off North Carolina and Florida where erosion would have destroyed any prehistoric resources in deeper water (USDOI, MMS, 1990f; SAI, 1981). As noted in Section IV.D.1.a(13), prior to the commencement of any of these bottom-disturbing activities, the "Protection of Archaeological Resources" stipulation will require proof that these activities will not affect prehistoric resources.

Accidents that can disturb prehistoric sites include spilled oil and clean-up activities associated with spilled oil. Under Alternative III, it is assumed that a small spill will occur in the vicinity of each of the support bases and at the mouth of Delaware Bay.

No impacts on prehistoric resources from routine activities are expected under this Alternative. Surveys required by the "Protection of Archaeological Resources" stipulation are expected to identify buried landforms with potential for prehistoric resources. Avoidance of these areas or further proof that no prehistoric resources exist, as required by the stipulation, would prevent the loss of archaeological information. If a prehistoric resource is contacted accidentally, most of the features which give it scientific integrity are expected to remain.

Small chronic spills that could occur during supply vessel refueling typically weather or are cleaned up before they have a chance to contaminate prehistoric resources. The C^{14} datable material that may be associated with these sites is expected, therefore, not to be affected by spills of this magnitude. Those sites that could be contacted by a small diesel fuel spill would be those that are already exposed to the environment and would already have been substantially altered. Cleanup of diesel fuel spills is assumed not to involve the removal of oiled sediments since diesel fuel tends to evaporate and does not leave behind tars and asphalt. Additionally, if a spill is smaller than 12 bbl, typically neither mechanical cleanup nor dispersants are used (NAS, 1989).

HISTORIC RESOURCES: The existing conditions of the Atlantic historic resources are described in Section IV.D.1.a(13)). Routine activities that disturb the ocean floor would have the greatest potential for affecting historic resources. Any objects placed on the ocean floor, such as drilling rigs and anchors, can crush a fragile wooden shipwreck. Dredging and burial activities during pipeline laying activities can also destroy historic shipwrecks. As with prehistoric resources, the "Protection of Archaeological Resources" stipulation would require proof that any bottom-disturbing activities would not affect historic resources.

Accidents that can disturb prehistoric sites include spilled oil and clean-up activities associated with spilled oil. For Alternative III, it is assumed that a small spill will occur in the vicinity of each of the support bases and at the mouth of the Chesapeake Bay. An oil spill greater than or equal to 1,000 bbl is not assumed to occur under Alternative III.

Surveys required by the "Protection of Archaeological Resources" stipulation are expected to identify potential shipwrecks throughout most of the OCS. It is expected that the assumed pipeline to the Charleston, SC area will pass through an area approximately 30 to 40 km (18.6 to 24.9 mi) wide, where the remains of shipwrecks would most likely be buried. Geophysical survey limitations in this area may not prevent a shipwreck being contacted. If pipeline construction were to contact a historic shipwreck, much of the valuable information could be destroyed. Given the shipwreck density near

Charleston and the assumed pipeline activity, it is expected that a shipwreck would be contacted. The "chance" find clause of the stipulation is expected to preserve much of the valuable information.

Small spills that could occur during supply vessel refueling will have little effect on historic shipwrecks and historic structures, even those in coastal areas. These small spills typically weather or are cleaned up before they have a chance to contact a sunken vessel or historic structure. Therefore, no impacts are expected from the small spills that are assumed to occur.

CONCLUSION: Activities under Alternative III are expected to result in a historic shipwreck being contacted by pipeline construction activities. Much of the valuable information is expected to be retained by compliance with the "chance" find clause of the "Protection of Archaeological Resources" stipulation. No impact is expected to occur to prehistoric resources.

n. Impacts on Recreation and Tourism

(1) Gulf of Mexico Region

Routine drilling and production in nearshore tracts within 10 miles of coastal park and recreation areas off the coast of Louisiana, Mississippi and Alabama will be visible from shore during fair weather conditions. Helicopters and boat traffic servicing offshore operations may also be seen and heard by recreational beach users and tourists. Pipeline construction across recreational beaches in Texas, Louisiana, and Mississippi or Alabama will remove 1,200-1,600 ft of beach shorefront from recreational use for 2-3 weeks while each landfall is under construction. Offshore platforms, especially those within 25 miles of shore will attract fish and fishermen. Selection of this alternative over the proposal would result in a 17 percent reduction in the number of platform installations estimated under the proposal, Gulfwide. In the northwestern Gulf this reduction would be approximately 10 percent, in the northcentral Gulf 18 percent, and in the northeastern Gulf 50 percent. Accidents associated with drilling, production and transportation of gas and oil will cause pollution and debris on coastal beaches. Three oil spills greater than or equal to 1,000 bbl would occur from the program-related activities and increased tanker imports due to decreased domestic production. The two 30,000-bbl import tanker spills would occur in the northwestern Gulf offshore Texas and in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. These import spills are assumed to occur offshore and neither is assumed to contact the Gulf's coastline or coastal and estuarine waters. One 25,000-bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. The larger size class oil spills would lead to closure of beach and park areas along the coasts of Louisiana and Texas for up to six weeks.

CONCLUSION: This alternative is expected to result in closure (less than a full season or 6 months) at a few park and recreation areas during one of the 45 years of the project life as a result of major oil spills. Tourist losses associated with these closures will be local and represent less than 10 percent of projected economic gains. Platforms installed offshore as a result of the proposal, especially those within 25 miles of shore, will attract recreational fishermen and divers.

(2) Pacific Region

Adoption of Alternative III has fewer lease sales proposed in the Alaska Region. As a consequence of Alternative III, one less tanker spill is hypothesized to occur along the west coast of the United States than was estimated in Alternative I. Even with a reduction in the total number of potential tanker oil spills, estimated impacts to recreation resources are unchanged because the spill was assumed to occur offshore northern California, more than 80 km (50 miles) offshore. It was not expected to contact the coast or affect recreation and tourist resources. Therefore, impacts to recreation resources in Alternative III are identical to those identified for Alternative I (Section IV.D.1.a(14)).

Installation of platforms within 16 km (10 miles) of the coast will cause a noticeable change in local scenery. Impacts of platform installation on tourism are expected to be inconsequential. Crew and supply vessels associated with hypothesized facilities are not expected to result in measurable impact to recreational boaters because these vessels will operate from existing ports and use established vessel traffic lanes.

Installation of offshore pipelines will temporarily disrupt recreational activities in the vicinity of the pipeline route for the duration of construction operations, approximately 3 - 4 months. No measurable impacts to the levels of tourism activities are expected in communities near pipeline installation operations.

Impacts to recreational resources from accidental pipeline spills or spills of Alaskan oil transported by tankers greater than 1,000 bbl include closure of the affected beach for approximately one month, temporary displacement of resource users to unaffected sites, financial losses to local merchants servicing the contaminated area, and temporary degradation of aesthetic qualities of the spill site. These impacts are expected to continue for the duration of clean up operations, approximately one month.

CONCLUSION: Routine operations assumed for Alternative III are not expected to affect recreation or tourism resources. A change of scenery quality is expected in areas where one or more platforms is installed within sight of the coast line. Accidental oil spills are expected to close recreation facilities at the affected site for one month. Recreation resource users would be temporarily displaced and local merchants deriving income from those users will experience an economic loss during the clean up period. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the proposal.

(3) Atlantic Region

The scenario for Alternative III assumes 10 fewer exploratory wells than the Alternative I, resulting in a total of 25. Other assumptions in this scenario result in a reduction from Alternative I levels of 29 development and production wells and 2 production platform for a total of 79 and 4, respectively. Other infrastructure components of the scenario assumed to be needed to support offshore operations under Alternative III remain the same as in the proposal. Therefore, 2 support bases, 3 gas pipelines, and 2 gas processing plants are assumed to be needed for production of hydrocarbon resources under Alternative III. A description of the potential impacts expected from these assumptions is given in Section IV.D.1.a(14). An oil spill greater than or equal to 1,000 bbl is not assumed under this scenario.

Under Alternative III, the potential for visual impact on the coastal visitor from drilling operations will be limited to the coastal county of Dare, NC. Because of the transitory nature of the recreational fishery, little impact on this industry from the presence of offshore drilling and production structures and their spatial exclusion zones are expected. Additionally, the Fisheries Training Program for offshore operators and notification efforts of the U.S. Coast Guard would help prevent collisions between recreational fishing vessels and drilling structures as well as fishing gear entanglement (see Section IV.D.1.a(14)).

Locating the support bases closely to already industrialized areas enhances their operating efficiency and prevents any change in access by visitors to public recreation sites (see Section IV.D.1.a(14)). A gas pipeline landfall, located in a tourist area, would result in closure of the area during construction. The acreage effect would be small and construction could be accomplished during the off-season. However, it is expected that Federal and State reviews will result in the location of landfall for the two assumed pipelines being directed away from sites that are important to the coastal recreation and tourism industry. Gas processing facilities are assumed to be built in areas of existing urban/industrial development. Therefore, access to public recreation sites is not expected to change (see Section IV.D.1.a(14)).

CONCLUSION: Under Alternative III, offshore operations will have a visual impact on the coastal visitor to barrier islands in Dare County, NC. A permanent visual impact is also expected along some sections of the maintenance ROW for the assumed gas pipelines. No long-term changes in the ability of the public to use recreation areas are expected.

4. Alternative IV — Exclude Additional Planning Areas

Alternative IV provides for no more than 18 sales in 8 of the planning areas identified in Table II.D.1-1. In Alternative IV, sales would be considered only in the Gulf of Mexico and Alaska Regions.

Under Alternative IV, no sale is considered for the Atlantic Region. Therefore, the impact analyses for the resources in the Atlantic Region for Alternative IV are identical to Alternative II (see Section IV.D.2).

RESOURCE ESTIMATES: Resource estimates for Alternative IV are presented in Table IV.D.4-1. Section IV.D.1.a provides a discussion on the PRESTO model used to calculate the resource estimates that are assumed to be leased, discovered and produced. These resource estimates are comparable to those of the proposal (Alternative I).

Table IV.D.4-1. Conditional Resource Estimates — Exclude Additional Planning Areas

REGION AND PLANNING AREA	OIL (BBO)	GAS (TCF)	MP_{HC}
GULF OF MEXICO REGION			
Western Gulf of Mexico	0.23	3.51	1.00
Central Gulf of Mexico	0.57	5.64	1.00
ALASKA REGION			
Beaufort Sea	0.52	—	0.16
Chukchi Sea	2.01	—	0.21
Hope Basin *or*	0.24	—	<0.01
St. George Basin	0.23	—	0.02
Norton Basin *or*	0.30	—	<0.01
St. Matthew-Hall *or*	<0.01	—	<0.01
Navarin Basin	0.24	—	0.03
Cook Inlet	0.16	—	<0.01
Gulf of Alaska	0.34	—	0.04

BBO - Billion Barrels of Oil
TCF - Trillion Cubic Feet
MP_{HC} - Marginal Probability of Commercial Hydrocarbons

EXPLORATION AND DEVELOPMENT ASSUMPTIONS: The hypothetical scenarios concerning exploration and development activities for Alternative IV were developed using the same assumptions as for Alternative I (Section IV.D.1.a). The level of offshore and onshore activities are based on the amount of hydrocarbon resources assumed to be leased, developed, and produced as a result of sales in Alternative IV (see Table IV.D.4-2 and IV.D.4-3).

TRANSPORTATION AND MARKET ASSUMPTIONS: The amounts of natural gas and oil resources assumed to be leased and developed in the Gulf of Mexico and Alaska Regions are the same as those of the proposal (Alternative I). The basic assumptions used in Alternative I concerning how gas and oil production will be transported to shore (Section IV.D.1.a) are still valid. It is also assumed that the amount of natural gas and oil that would be forgone as a result of the adoption of Alternative IV would be replaced by the importation of oil by foreign tankers (see Section IV.D.2-1).

Table IV.D.4-2. Exploration And Development Activity — Exclude Additional Planning Areas

Planning Area	Sales (No.)	BBOE	MPHC	Exp./Del. Wells (No.)	Dev./Pro. Wells (No.)	Platforms (No.)	Years Of Activity
Western Gulf of Mexico	5	.86	1.00	1000	540	50	1993-2030
Central Gulf of Mexico	5	1.58	1.00	1380	980	110	1994-2031
Beaufort Sea	2	.52	0.16	12	70	3	1994-2021
Chukchi Sea	2	2.01	0.21	47	268	7	1995-2025
Hope Basin *or*	1	.24	<0.01	8	34	1	1996-2021
St. George Basin	1	.23	0.02	8	50	1	1996-2021
Norton Basin *or*	1	.30	<0.01	11	66	1	1997-2022
St. Matthew-Hall *or*	1	<.01	<0.01	6	—	—	1997-1999
Navarin Basin	1	.24	0.03	8	48	1	1997-2022
Cook Inlet	1	.16	<0.01	6	26	1	1995-2019
Gulf of Alaska	1	.34	0.04	11	53	1	1996-2021

MPHC - Marginal Probabilty Of Commercial Hydrocarbons
BBOE - Billion Barrels of Oil Equivalent

Table IV.D.4-3. New Offshore and Onshore Infrastructure — Exclude Additional Planning Areas

Planning Area	Platforms (No.)	Oil and Gas Pipelines[3,6] (No.)	Oil and Gas Pipelines (Miles)	Pipeline Landfalls (No.)	Shore Bases/ Support Facilities (No.)
Western Gulf of Mexico	50	–	1020	2	2[1]
Central Gulf of Mexico	110	–	1240	2	2[2]
Beaufort Sea	3	–[4]	275	1	1[5]
Chukchi Sea	7	–[4]	250	1	1[5]
Hope Basin *or*	1	1	90	1	1[5]
St. George Basin	1	–	–	–	1[5]
Norton Basin or	1	–	–	–	–[5]
St. Matthew-Hall *or*	–	–	–	–	1
Navarin Basin	1	–	–	–	–
Cook Inlet	1	1	25	1	1[5]
Gulf of Alaska	1	1	100	1	1[5]

1. Gulf of Mexico Region - additional support facilities: 2 new marine terminals.
2. Gulf of Mexico Region - additional support facilities: 1 new marine terminal and 1 new pipeline yard.
3. Alaska Region - oil pipelines only.
4. Alaska Region - offshore gathering system.
5. Shorebases can include tank farms, docks, air bases, utilities, supply depots and personnel quarters.
6. Gulf of Mexico Regions - oil and gas pipelines are layed along the same pipeline corridor.

The likely mix of market-driven replacements for the forgone hydrocarbons is shown in Table IV.D.2-1. The imported oil replacing the forgone OCS natural gas and crude oil would represent approximately 1,000 trips by a 30,000 dwt tanker to ports in the Atlantic Region, approximately 50 trips to ports in the Gulf of Mexico Region by 100,000 dwt tankers, and approximately 570 trips to ports in the Southern California Planning Area by 100,000 dwt tankers.

OIL SPILL ASSUMPTIONS:

Oil Spills Greater Than or Equal to 1,000 bbl. Table IV.D.4-4 presents the number and type of oil spills assumed to occur as a result of OCS activity associated with Alternative IV. The source and number of assumed spills were based on the volume of oil listed in Table IV.D.4-1, assumptions on the mode of transportation, and spill rates for spills greater than or equal to 1,000 bbl (see Section IV.D.1.a). Table IV.D.4-5 presents the probabilities of one or more spills of 1,000 bbl or greater and 10,000 bbl or greater occurring. These probabilities are based on the total estimated mean number of spills assumed to occur as a result of oil production from the adoption of Alternative IV. It is also assumed that these spills would occur with uniform frequency over the life of the alternative.

Table IV.D.4-4. Oil Spill Assumptions — Exclude Additional Planning Areas

	Assumed Oil Spills[3]		
Planning Area	Platform (Nos.)	Pipeline (Nos.)	Tanker (Nos.)
Western Gulf of Mexico	–	1	–
Central Gulf of Mexico	1	1	–
Beaufort Sea	–	1	1
Chukchi Sea	1	2	3
Hope Basin *or*	–	–	1
St. George Basin	–	–	1
Norton Basin *or*	–	–	1
St. Matthew-Hall[2] *or*	–	–	–
Navarin Basin	–	–	1
Cook Inlet	–	–	1
Gulf of Alaska	–	–	1

1. No spill was assumed — exploration activity only.
2. Based on the total estimated mean number of spills greater than or equal to 1,000 bbl.

Table IV.D.4-6 presents the assumed locations of the tanker spills along the tanker routes. Tanker spills resulting from production in the Beaufort and Chukchi Sea Planning Areas are assumed to occur outside of those planning areas. Oil produced in the Beaufort and Chukchi Sea Planning Areas would be transported by the TAPS to the Valdez terminal facilities and then transported by tanker to west coast ports. Based on the destination and amount of the TAPS oil shipped from Valdez to west coast ports (Puget Sound, Washington; San Francisco and Los Angeles, California), it is reasonable to assume that a tanker spill could occur along the tanker routes to these ports.

Table IV.D.4-5. Oil Spill Probabilities — Exclude Additional Planning Areas

Planning Area	Oil (BBO)	MP_{HC}	Probability of 1 or more spills occurring 1,000 bbl or greater	10,000 bbl or greater
Western Gulf of Mexico	0.23	1.00	28%	10%
Central Gulf of Mexico	0.57	1.00	52%	22%
Beaufort Sea	0.52	0.16	73%	48%
Chukchi Sea	2.01	0.21	**%	96%
Hope Basin *or*	0.24	<0.01	47%	27%
St. George Basin	0.23	0.02	34%	21%
Norton Basin *or*	0.30	<0.01	41%	25%
St. Matthew-Hall *or*	<0.01	<0.01	—	—
Navarin Basin	0.24	0.03	34%	21%
Cook Inlet	0.16	<0.01	34%	18%
Gulf of Alaska	0.34	0.04	59%	34%

**probability of one or more spills occurring is greater than 99.5%

BBO - Billion Barrels of Oil

Table IV.D.4-6. Oil Spill Assumptions — Exclude Additional Planning Areas Assumed Location of Tanker Spills

Planning Area Location of the Tanker Spill	Assumed Tanker Spills (Nos.)
Hope Basin *or*	1
St. George Basin	1
Norton Basin *or*	1
Navarin Basin	1
Cook Inlet	1
Gulf of Alaska	2
Washington and Oregon	1
Northern California	1
Southern California	1

The probabilities of one or more pipeline or platform spills equal to or greater than 1,000 bbl, and equal to or greater than 10,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 46 percent and 92 percent, and 19 percent and 57 percent, respectively. As a result of the transportation of oil from the Chukchi Sea Planning Area, there is a 93-percent probability of one or more spills of 1,000 bbl or greater occurring and an 81-percent probability of one or more spills of 10,000 bbl or greater occurring. As a result of the transportation of oil from the Beaufort Sea Planning Area there is a 46-percent probability of one or more spills of 1,000 bbl or more occurring and 36-percent probability of one or more spills of 10,000 bbl or greater occurring.

As the result of the importation of foreign oil to replace the forgone OCS natural gas and oil, it was assumed that one tanker spill greater than or equal to 1,000 bbl would occur in the Pacific Region. Since the estimated mean number of spills associated with the importation of foreign crude oil was less than 0.12 in the Atlantic Region, no spill was assumed for these imports. It was assumed that the substitute import spill and spills assumed to occur as a result of Alternative IV would occur with uniform frequency over the life of the alternative.

Oil Spills Greater Than 1 bbl and Less Than 1,000 bbl. Table IV.D.4-7 presents the estimated mean number of spills assumed to occur as a result of the adoption of Alternative IV. Section IV.D.1.a presents the assumptions used in the calculation of small spills.

Table IV.D.4-7. Small Spill Assumptions — Exclude Additional Planning Areas

Planning Area	Assumed Small Spills $>1 \leq 50$ bbl[1]	Assumed Small Spills $>50 < 1{,}000$ bbl[2]
Western Gulf of Mexico	31	1
Central Gulf of Mexico	77	3
Beaufort Sea	132	5
Chukchi Sea	515	21
Hope Basin *or*	61	2
St. George Basin	58	2
Norton Basin *or*	76	3
St. Matthew-Hall *or*	–	–
Navarin Basin	61	2
Cook Inlet	41	2
Gulf of Alaska	86	3

Small Spills Rates per billion bbls of oil produced:

1. Gulf of Mexico Region - 135; Alaska Region - 253.63
2. Gulf of Mexico Region - 5 ; Alaska Region - 10.25

a. Impacts on Water Quality

(1) Gulf of Mexico Region

As a result of the proposed alternative, it is estimated that there will be a reduction in OCS activities (including discharges) which correspond to the reduced resource discovery and production. The greatest reduction in offshore exploration and production and associated infrastructure support would occur offshore Florida. Offshore Florida, 100 percent of the activities estimated to support the proposal would be forgone, along with all associated effluent discharges and bottom disturbing activities (an estimated 0.9 million yd^3 of disturbed sediments). Immediate effects would be brought about by increased drilling, construction and pipelaying activities, causing an increase in water column turbidities (lasting for several hours with mud discharges to several weeks with dredging-pipelaying activities) to the affected offshore waters. The magnitude and extent of turbidity increases would depend on the hydrographic parameters of the area, nature and duration of the activity, and bottom-material size and composition. As in the Alternative I analysis, offshore Texas would receive the greatest portion of program-related pipeline burial activities, whereas, offshore Louisiana would receive the largest amounts of program-related operational discharges. Because of the continuous nature of oil and gas activities in the northwestern and northcentral Gulf of Mexico, the frequency of drilling mud and cutting and produced water discharges is judged to occur nearly continuously throughout these areas. Proposed produced water discharges (approximately 1.7 billion bbl) will be rapidly diluted offshore within the immediate vicinity of the discharge source. Another 218 million bbl of produced waters will be transported ashore for separation, treatment, and disposal. Significant increases in water concentrations of dissolved and particulate hydrocarbons and trace metals are not expected outside the initial mixing zone or immediate vicinity of the discharge source. Higher concentrations of trace metals, salinity, temperature, organic compounds, and radionuclides, and lower dissolved oxygen may be present near the discharge source. Long-term effects to water column processes, consisting of localized increases in particulate metal and soluble lower molecular weight hydrocarbons (e.g., benzene, toluene, and xylenes) concentrations, may be implicated within the mixing zone of the discharge. Trace metals and hydrocarbons associated with the discharge may be deposited within sediments near the discharge point. The proposed discharge of 22.25 million bbl of drilling fluids and 6.55 million bbl of drill cuttings would encounter rapid dispersion in marine waters. Discharge plumes will be diluted to background levels within a period of several hours and/or within several hundred meters of the discharge source. The accumulation of toxic trace metals and hydrocarbons in exposed shelf waters, due to periodic releases of water-based generic muds and cuttings, are unlikely and the long-term degradation of the water column from such discharges are not major concerns. Eighteen percent or 5 million bbl of drilling fluids (muds) would be transported onshore for disposal.

One 25,000 bbl pipeline spill is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Booming would serve to preclude impacts to estuarine waters there. No oil spills greater than 50 bbl and less than 1,000 bbl are expected to impact coastal and nearshore waters. However, several spills (greater than one and less than or equal to 50 bbl) are likely to result from OCS program-related activities both in the coastal zone and from offshore. Few of these offshore spills will contact the Gulf's coastline. Program-related spills will introduce oil into nearshore waters, creating elevated hydrocarbon levels (up to 100+ug/l) within affected waters. Much of the oil will be dispersed throughout the water column over several days to weeks. In shallow areas, oil may become entrained in suspended particles and bottom sediments. Water uses would be affected for up to several weeks from proposed spills and then only near the source of slick.

CONCLUSION: As a result of this alternative, an identifiable change to the ambient concentration of one or more water quality parameters will be evident up to several hundred meters from the source and for a period lasting up to several weeks in duration in marine and coastal waters. In poorly flushed coastal waterbodies, localized increases in trace metal and hydrocarbon concentrations may be severe and persist for months or longer. Chronic, low level pollution related to the proposal will occur throughout the 45-year life of the proposal.

(2) Alaska Region

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Water quality impacts would be the same as Alternative I. Section IV.D.1.a(1) describes the potential impacts on water quality.

CONCLUSION: Trace metal and oil and grease concentrations in discharges are not likely to exceed water-quality criteria outside a 100-m radius around each drill site or production platform. Discharges would reduce water quality on considerably less than 1 percent of the area identified under the proposal. This reduction in water quality would exist only during periods of actual discharge and would rapidly dissipate on completion of their discharge. Water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for a short period of time (about 30 days). The principal cause of impacts is spilled oil, and the probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal ranges from 18 to 92 percent.

(3) Pacific Region

Under Alternative IV, all the blocks being considered for future leasing in the Southern California Planning Area would be excluded from the Comprehensive Program. Therefore, impacts to resources in the Pacific Region under this alternative could only be due to the tankering of Alaskan and foreign oil.

The oil spill assumptions for the Alaska Region do not change from Alternative I under this alternative and include one 30,000-bbl tanker spill each off Washington, northern California, and southern California. It is assumed that oil not produced on the Pacific OCS will be replaced by imported oil, and that one foreign tanker spill of 30,000 bbl of oil will occur in the Southern California Planning Area as a result of this substitution. The northern California spill is assumed to occur more than 80 km from the coast; the remaining three spills are assumed to occur within 80 km of the coast and contact the shoreline.

Section IV.A discusses the generic impacts of accidental oil spills on water quality. Oil spills of 1,000 bbl or more impact water quality primarily at local and sub-regional levels. The parameters affected include oil and grease, dissolved oxygen, turbidity, trace metals, and others. As was discussed for Alternative I (Section IV.D.1), oil from the spills assumed to occur as the result of Alternative IV is expected to elevate hydrocarbon levels up to 100+ ug/l and limit water use in areas of 1,000-2,000 km^2 over a period of several days to weeks.

CONCLUSION: Adoption of Alternative IV is expected to result in temporary effects on water quality and water use in the Pacific Region over an area of a thousand square kilometers or more for a period of several weeks.

b. Impacts on Air Quality

(1) Gulf of Mexico Region

Under this alternative, emissions of the five primary pollutants will be approximately 96 percent of those estimated for Alternative I. Emissions from OCS offshore activities in the northwestern and northcentral Gulf represent 100 percent of the total emissions estimated. No OCS program-related emissions are expected for the northeastern Gulf. Selection of this alternative over the proposal would not reduce emissions estimated under the proposal for the northwestern and northcentral Gulf. Exclusion of the Eastern Gulf Planning Area represents a four percent reduction in total emissions, Gulfwide. Emissions will be greater in the northwestern and northcentral Gulf based on OCS development trends. Total emissions of the five primary pollutants from proposed new wells, platforms, and vessels ranges from 23,000 to 321,000 metric tons of the proposed 45-year life of the program. Total emissions estimated from proposed new wells, platforms, and vessels in the Gulf indicates that wells will contribute mostly NO_x, platforms mostly NO_x, CO, and VOC, and vessels will contribute all pollutants. During the early years of the proposed action, emissions would be small and increase over time as production increases. After reaching a maximum, emissions decrease rapidly to zero as the proposed action scenario assumes all platforms and wells will be removed and service vessels trips no longer needed.

For spills greater than or equal to 1,000 bbl, emissions are of order 285 tons/hour or smaller. Concentrations reaching onshore areas from these spills would be on the same level as before based on the dispersion, limited input of pollutants to the atmosphere, and transport regime present. The emissions from the oil spills will last until all the volatile compounds are evaporated, and this takes about three days. About four percent of OCS crude-oil production is offloaded from surface vessels at ports off Texas and the northern coast of the Gulf. Off Florida up to 25 percent of the OCS production would be offloaded from surface vessels. The unintentional emissions from these offloading operations are unknown, but are estimated to be negligible (von Bodungen, pers. comm., 1988) in the northern coast of the Gulf. Off Florida, unintentional emissions from offloading crude would be negligible because of the crude oil production estimated.

CONCLUSION: Emissions of pollutants into the atmosphere from the activities associated with the proposed action are likely to have concentrations that would not change onshore air quality classifications because of the prevailing atmospheric conditions and emissions height. Onshore concentrations of air pollutants from the proposed program-related emissions are estimated to be near 1 ug/m^{-3} (annual average) because the atmospheric regime, the emissions, and distance of these emissions from the coastline. Based an the above reasons and propositions, the air quality status in the Gulf of Mexico will not change because the emissions from proposed activities.

(2) Alaska Region

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Air quality impacts would be the same as Alternative I. Section IV.D.1.a(2) describes the potential impacts on air quality.

CONCLUSION: Based on the scenario assumptions, Alternative IV is expected to cause NO_x concentration increases to the ambient air by 0.3 to 0.7 ug/m3 at the shoreline during exploration and 0.01 to 0.17 ug/m3 at the shoreline during production. Concentrations of other pollutants would range from 3 to 50 percent of NOx concentrations. Increased concentrations of SO_2 and VOC from spilled oil are expected to be less than from normal operations and last a short period after emissions cease.

(3) Pacific Region

Adoption of Alternative IV excludes OCS leasing activities in the Southern California Planning Area. By excluding leasing activities, routine exploratory and developmental operations described in Alternative I, such as drilling, platform installation, or installation of offshore pipelines will not occur in the planning area. Therefore, no impacts to air quality are anticipated to occur.

No new onshore facilities or new pipeline landfalls will occur in southern California as a result of Alternative IV. Consequently, no impacts to onshore air quality are expected.

As a consequence of Alternative IV, the pipeline spill hypothesized in Alternative I (Section IV.D.1.a(3)) does not occur. However, one 30,000 bbl tanker spill of imported oil is assumed to occur in southern California for this alternative. Impacts would depend on the composition of the crude oil, location of the spill, and weather conditions at the time. Information taken from Form and Substance, Inc.(1983) indicates that total hydrocarbon emissions during the first hour would be approximately 57 lbs/bbl, decreasing to 29 lbs/bbl in the second hour. Assuming the spill hypothesized for the Southern California Planning Area occurs within one hour, total emissions during the first and second hour would be 1,710,000 lbs and 870,000 lbs respectively. In the event the spill occurs nearshore, impacts could result in short-term exceedance of the onshore standard in the vicinity of the spill for the duration of the spill. Spills greater than 3 miles from shore are not expected to have long-term, measurable effects on onshore air quality.

Three tanker spills of 30,000 bbl each are assumed to occur along the tanker route in the Pacific Region from Alaskan production: one off the Washington coast, one off northern California, and one off southern California. The tanker spills off Washington and southern California are assumed to occur within 80 km of the coast and to contact the shoreline. The northern California spill is assumed to occur more than 80 km from the coast with no shoreline contact. In the event of a tanker spills, total emissions for each spill during the first and second hour would be 1,710,000 lbs and 870,000 lbs respectively. In the event the spill occurs nearshore, impacts to the Washington and southern California areas could result in short-term exceedance of the onshore standard. Effects would not be discernable for the spill off northern California since it is assumed to be further offshore.

CONCLUSION: Selection of Alternative IV would eliminate the need for offsets in California (approximately 5 percent of existing onshore emissions). In the event of an accidental spill, local air quality standards off the Washington and southern California planning areas in the vicinity of the spill will be temporarily exceeded. These exceedances are expected to last for the duration of a spill, but are not expected to result in long term effects to onshore air quality.

c. Impacts on Marine Mammals

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect endangered and threatened cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to endangered and threatened cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb endangered and threatened cetaceans because of prohibitions by MMS and adherence to FAA recommended minimum ceilings. The effects on endangered and threatened cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on endangered and threatened cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on endangered and threatened cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect endangered and threatened cetaceans. The effect on endangered and threatened cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation. (A generation is defined as the term of years accepted as the average period between the birth of the parents and the birth of their offspring.)

CONCLUSION: As a result of this alternative, there will be no discernible decline in an endangered or threatened cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges from 10 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Nonendangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb cetaceans because of prohibitions by MMS and adherence to FAA recommended minimum ceilings. The effects on cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect cetaceans. The effect on cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: As a result of the proposed action, there will be no discernible decline in a cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges from 10 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Alaska Region

(a) Threatened or Endangered Species

1) Cetaceans

a) Bowhead Whale

Because the assumed level of activity within the range of the bowhead whale is the same as Alternative I, effects on this species due to Alternative IV would be as discussed for Alternative I (see Section IV.D.1.a(3)).

CONCLUSION: Based on the scenario assumptions , it is expected that Alternative IV would have sublethal effects on up to 40 percent of the bowhead population per year due to noise and up to 20 percent of the population due to oil spills. None of the sublethal effects are expected to affect recruitment or distribution of the species.

b) Fin and Humpback Whales

Except for exploration and production activities in California, Alternative IV is the same as Alternative I in areas within the range of fin and humpback whales. Hence, in areas outside of California, effects on these species due to Alternative IV would be as discussed Alternative I. This amounts to sublethal effects on up to 20 percent per year of their populations due to noise, and sublethal effects on up to 10 percent of their populations due to oil spills. None of the sublethal effects are expected to affect recruitment or distribution of these species.

However, since Alternative IV proposes no exploration or production activity in California, this alternative would reduce the overall activity level within the range of these species by about one third that of Alternative I. Therefore, the expected sublethal effects from routine activities would be somewhat less under Alternative IV. Since there is no change in the number of oil spills for the California area, effects due to oil spills for these two species would be the same as Alternative I.

CONCLUSION: Based on the scenario assumptions, it is expected that Alternative IV would have sublethal effects on up to 15 percent of the fin and humpback whale populations per year due to noise and up to 8 percent of the population due to oil spills. None of the sublethal effects are expected to affect recruitment or distribution of these species.

c) Right, Blue, Sei, and Sperm Whales

Except for exploration and production activities in California, Alternative IV is the same as Alternative I in areas within the range of right, blue, sei, and sperm whales. Hence, in areas outside of California effects on these species due to Alternative IV would be as discussed for Alternative I. This amounts to sublethal effects on up to 10 percent per year of their populations due to noise, and sublethal effects on up to 5 percent of their populations due to oil spills. None of the above effects are expected to affect recruitment or distribution of these species.

However, since Alternative IV proposes no exploration or production activity in California, this alternative would reduce the overall level of such activities within the range of these species by about one third that of Alternative I. Therefore, the expected sublethal effects from routine activities would be somewhat less under Alternative IV. Since there is no change in the number of oil spills for the California area, effects due to oil spills for these two species would be the same as the proposal.

CONCLUSION: Based on the scenario assumptions, it is estimated that Alternative IV would have sublethal effects on up to 8 percent of the right, blue, sei and sperm whale populations per year due to noise and up to 3 percent of the population due to oil spills. None of the sublethal effects are expected to affect recruitment or distribution of these species.

2) Pinnipeds

STELLER SEA LION: Aircraft and vessel support operations and onshore construction activities are the most likely sources of routine disturbance that could affect sea lion distribution and abundance in the California area. Oil spills are expected to result in sublethal effects if they contact adults, but pups may be abandoned and die if oil interferes with formation of the mother-pup bond or swimming/breathing/temperature regulation capability, and may cause adverse impacts if prey availability is affected. Subsequent containment and cleanup operations in the vicinity of sea lion concentrations are likely to result in disturbance and abandonment of the affected areas for the duration of the activity.

Routine disturbance under Alternative IV is expected to have little impact on sea lions, requiring a generation or less for recovery, due to their concentration away from intensive OCS activities and small proportion of individuals likely to be exposed to such activities. Thus, removal of the southern California sale from the program is expected to result in a minor reduction of impact.

It is assumed that by deleting the southern California sale from the program a portion of the oil and gas forgone will be replaced by oil imported into California. Based on the amount of replacement imports, it is assumed that one 30,000-bbl foreign tanker spill will occur offshore southern California. This tanker spill poses a greater environmental risk than the pipeline spill assumed for the proposal. In particular, the Channel Islands breeding population is expected to be at greater risk from a tanker spill, with the potential for occurring closer to the islands as a result of nearby shipping lanes, than a pipeline spill that is likely to occur nearer the coast (although an offshore wind could move a spill seaward toward the islands). Oil spill impact on this segment of the sea lion population is expected to require two generations for recovery. Impact on the North Pacific sea lion population from losses in California is expected to require one generation or more for recovery. Overall oil spill impact on the North Pacific population is expected to be similar to that estimated for Alternative I, requiring three or more generations for recovery.

Removal of the southern California sale from the program under this alternative is expected to result in disturbance impact on the Steller sea lion similar to Alternative I, requiring a generation or less for recovery. Oil spill impact on the California segment of the sea lion population is expected to require two generations for recovery. Impact on the North Pacific sea lion population from losses in California is expected to require one generation or more for recovery. Overall oil spill impact on the

North Pacific population is expected to be similar to that estimated for Alternative I, requiring three or more generations for recovery.

CONCLUSION: Based on the scenario, routine disturbance impacts on the sea lion under Alternative IV are expected to be similar to Alternative I, requiring one generation or less for recovery. Oil spill impacts are expected to be similar to Alternative I for the North Pacific population, still requiring three or more generations for recovery to its original status.

(b) Nonendangered Species

1) Cetaceans

a) Beluga Whale

Because the assumed level of activity within the range of the beluga whale is the same as Alternative I, effects on this species due to Alternative IV would be as discussed for Alternative I (see Section IV.D.1.a(3)).

CONCLUSION: The primary effects on beluga whales are expected to come from noise and disturbance, especially icebreaking activities, and other marine-vessel traffic and oil spills. Noise and disturbance from icebreakers and other marine traffic are expected to temporarily displace or interfere with beluga whale movements within a few to several miles of the activities. Few beluga whales are likely to die from contact with the oil spills. The loss of beluga whales from assumed oil spills (perhaps 100 whales or less) in the Alaskan populations is expected to be less than the losses due to natural mortality.

b) Minke Whale

Under Alternative IV, all the blocks being considered for future leasing in the Southern California Planning Area would be excluded from the Comprehensive Program, while the proposed action for the Alaska region remains unchanged. Therefore, impacts to resources in the Pacific Region under this alternative could only be due to the tankering of Alaskan and foreign oil.

Under Alternative IV, potential impacts to minke whales from routine activities could occur only in the Alaska Region and are likely to decrease somewhat with the exclusion of the Pacific Region blocks, but not differ substantially from those discussed for Alternative I. These activities include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Section IV.D.1.a provides a discussion of potential impacts on the minke whale population and an analysis of the impacts expected as a result of the Alternative I.

As in Alternative I, effects on minke whales from routine activities are expected to be sublethal and temporary in nature, including primarily avoidance reactions and changes in direction at distances up to 5 km from the source. It is expected that minke whales in the Alaska Region will be displaced from a few square kilometers of foraging area for one season or less by construction activities.

The oil spill assumptions for the Alaska Region do not change from Alternative I under this alternative and include one 30,000-bbl foreign tanker spill each off Washington, northern California, and southern California. It is assumed that a portion of the oil and gas not produced on the Pacific OCS will be replaced by imported oil, and that one tanker spill of 30,000 bbl of oil will occur in the Southern California Planning Area as a result of this substitution. The northern California spill is assumed to occur more than 80 km from the coast; the remaining three spills are assumed to occur within 80 km of the coast and contact the shoreline.

As in Alternative I, it is expected that the oil spills assumed to occur under Alternative IV will cause no minke whale mortality and will not disrupt migratory movements through the Alaska and Pacific Regions.

CONCLUSION: Alternative IV is expected to result in sublethal effects on minke whales lasting no more than a few months. No discernible changes in minke whale abundance or distribution are expected.

2) Pinnipeds

a) Northern Fur Seal

Aircraft and vessel support operations and construction activities are the most likely sources of routine disturbance that could affect fur seal distribution and abundance in the California area. Oil spills are expected to result in lethal effects if they contact fur seals and may cause adverse impacts if prey availability is affected. Subsequent containment and cleanup operations in the vicinity of fur seal concentrations are likely to result in disturbance and abandonment of the affected areas for the duration of the activity.

Routine disturbance under Alternative I is expected to have little impact, requiring less than a generation for recovery, on either wintering Pribilof fur seals that are dispersed offshore, or the resident San Miguel Island population that is concentrated away from intensive OCS activities, due to the small proportion of individuals likely to be exposed to such activities. Thus, removal of the southern California sale from the program is expected to result in a minor reduction of impact.

It is assumed that by deleting the southern California sale from the program a portion of the oil and gas forgone will be replaced by oil imported into California. Based on the amount of replacement imports, it is assumed that one 30,000-bbl foreign tanker spill will occur offshore southern California. This tanker spill poses a greater environmental risk than the pipeline spill assumed for the proposal. In particular, the San Miguel breeding population is expected to be at greater risk from a tanker spill, with the potential for occurring closer to the island as a result of a shipping lane located within about 21 km, than a pipeline spill that is likely to occur nearer the coast (although an offshore wind could move a spill seaward toward the island). Oil spill impact on this segment of the fur seal population is expected to require three or more generations for recovery; however, impact on the North Pacific fur seal population from losses in California is expected to require one generation or less for recovery. Recovery of the dispersed overwintering Pribilof population from any oil spill impact in this area is expected to require less than one generation. Overall oil spill impact on the North Pacific population is expected to be similar to that estimated for Alternative I, requiring two to three generations (4 to 6 years per generation) for recovery.

Removal of the southern California sale from the program under this alternative is expected to result in disturbance impact on the northern fur seal similar to Alternative I, requiring less than a generation for recovery. Oil spill impact on the San Miguel segment of the fur seal population is expected to require three or more generations for recovery; however, impact on the North Pacific fur seal population from losses in California is expected to require one generation or less for recovery. Overall oil spill impact on the North Pacific population is expected to be similar to that estimated for Alternative I, requiring two to three generations for recovery.

CONCLUSION: Based on the scenario, routine disturbance impact on the northern fur seal under Alternative IV are expected to be similar to Alternative I, requiring less than one generation for recovery. Oil spill impacts, while expected to be more severe for the San Miguel population than under Alternative I, are expected to be similar to Alternative I for the entire North Pacific population, still requiring two to three generations for recovery to its original status.

b) Ice Seals

The general range of all four species extends from the Beaufort Sea to the southeastern Bering Sea. The level of activity associated with Alternative IV within the range of ice seals is the same as Alternative I. Impacts on ice seal populations would be the same as Alternative I. Section IV.D.1.a(3) provides an analysis of the expected impacts.

CONCLUSION: Oil spills associated with Alternative IV are expected to result in some death among severely stressed adults of newborn ice seals. Such incidents are not expected to cause losses exceeding a few hundred individuals or that could not be replaced within a generation. Because adults and adults with young are widely dispersed for most of the year, helicopter flights and vessel traffic associated with alternative are expected to disturb a small portion of the seal populations and result in insubstantial effects on their distribution or migration.

c) Harbor Seal

Aircraft and vessel support operations and onshore construction activities are the most likely sources of routine disturbance that could affect harbor seal distribution and abundance in the California area. Oil spills are expected to result in sublethal effects if they contact harbor seals, although pups may be abandoned and die if oil interferes with formation of the mother-pup bond or swimming/breathing capability, and may cause adverse impacts if prey availability is affected. Subsequent containment and cleanup operations in the vicinity of harbor seal concentrations are likely to result in disturbance and abandonment of the affected areas for the duration of the activity.

Routine disturbance under Alternative I is expected to have little impact on harbor seals, requiring less than a generation for recovery, due to their concentration away from intensive OCS activities and small proportion of individuals likely to be exposed to such activities. Thus, removal of the southern California sale from the program is expected to result in a minor reduction of impact.

It is assumed that by deleting the southern California sale from the program a portion of the oil and gas forgone will be replaced by oil imported into California. Based on the amount of replacement imports, it is assumed that one 30,000-bbl foreign tanker spill will occur offshore southern California. This tanker spill poses a greater environmental risk than the pipeline spill assumed for the proposal. In particular, the Channel Islands breeding population is expected to be at much greater risk from a tanker spill, with the potential for occurring closer to the islands as a result of nearby shipping lanes, than a pipeline spill that is likely to occur nearer the coast (although an offshore wind could move a spill seaward toward the islands). Oil spill impact on this segment of the harbor seal population is expected to require one or more generations for recovery; however, impact on the North Pacific harbor seal population from losses in California is expected to require one generation or less for recovery. Overall oil spill impact on the North Pacific population is expected to be similar to that estimated for Alternative I, requiring one or more generations (4 to 6 years per generation) for recovery.

Removal of the southern California sale from the program under this alternative is expected to result in disturbance impact on the harbor seal similar to Alternative I, requiring less than a generation for recovery. Oil spill impact on the California segment of the harbor seal population is expected to require one or more generations for recovery; however, impact on the North Pacific harbor seal population from losses in California is expected to require one generation or less for recovery. Overall oil spill impact on the North Pacific population is expected to be similar to that estimated for Alternative I, requiring one or more generations for recovery.

CONCLUSION: Based on the scenario, routine disturbance impacts on the harbor seal under Alternative IV are expected to be similar to Alternative I, requiring less than one generation for recovery. Oil spill impacts are expected to be similar to Alternative I for the entire North Pacific population, still requiring one or more generations for recovery to its original status.

d) Pacific Walrus

The general range of the Pacific Walrus extends from the Beaufort Sea to the southeastern Bering Sea. The level of activity associated with Alternative IV within the range of the Pacific walrus is the same as Alternative I. Impacts on Pacific walrus populations would be the same as Alternative I. Section IV.D.1.a(3) provides an analysis of the expected impacts.

CONCLUSION: Based on the assumptions for Alternative IV, adult walruses are expected to experience few fatalities. Calves, however, could experience fatal effects by contact or ingestion of oil. Population effects resulting from oil spills are not expected to require more than one generation (10 to 15 years per generation) for recovery. Effects of disturbance from routine activities are not expected to be sufficiently adverse to elevate the aggregate effect of oil spills plus disturbance substantially above that for oil spills alone. There is a 21 to 92 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the Pacific walrus over the 30-year life of the proposal.

3) Sea Otter (Alaska Population)

Sea otters are resident from the northern Gulf of Alaska westward and in scattered localities in the northeastern gulf and southeast Alaska. Routine activities and accidental events associated with Alternative IV within the range of the Alaskan population of sea otters are the same as Alternative I. Impacts on sea otter populations would be the same as Alternative I. Section IV.D.1.a provides an analysis of the expected impacts.

CONCLUSION: Based on the scenario assumptions for Alternative IV, oil spills are expected to cause mortality requiring two generations or more for recovery. Disturbance from oil-spill-cleanup activities is expected to cause a local abandonment of habitat for a variable period and require up to a generation for recovery. There is a 18 to 81 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the sea otter over the 30-year life of the proposal.

4) Polar Bear

Polar bears inhabit the Beaufort and Chukchi and the northern Bering Seas, and therefore routine and accidental events associated with Alternative IV within the range of the polar bear are the same as Alternative I. Impacts on the polar bear would be the same as Alternative I. Section IV.D.1.a provides an analysis of the expected impacts.

CONCLUSION: Based on the oil spill assumptions, Alternative IV is expected to cause pathological conditions and mortality in polar bears requiring no more than one generation for recovery over the major proportion of their range where densities are low. However, these effects are expected to involve many more individuals where bears are concentrated near abundant prey, and result in losses requiring a generation (5 to 8 years) or more for the population to return to its initial status. The probability of one or more spills of 10,000 bbl occurring in the planning areas where polar bears are located ranges from 19 percent to 57 percent over the 30-year life of the proposal.

(3) Pacific Region

(a) Threatened or Endangered Species

1) Cetaceans

GRAY WHALE: Under Alternative IV, all the blocks being considered for future leasing in the Southern California Planning Area would be excluded from the Comprehensive Program, while the proposed action for the Alaska region remains unchanged. Therefore, impacts to resources in the Pacific Region under this alternative could only be due to the tankering of Alaskan and foreign oil.

Under Alternative IV, potential impacts to gray whales from routine activities could occur only in the Alaska Region and are likely to decrease somewhat with the exclusion of the Pacific Region blocks, but not differ substantially from those discussed for Alternative I. These activities include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Section IV.D.1.a(3) provides a discussion of potential impacts on the gray whale population and an analysis of the impacts expected as a result of Alternative I.

As in Alternative I, effects on gray whales from routine activities are expected to be sublethal and temporary in nature, including primarily avoidance reactions and changes in direction at distances up to 5 km from the source. No disruption of gray whale migration through the Alaska Region is expected. In the species' Bering and Chukchi Sea feeding grounds, gray whales may be displaced from areas of a few tens of square kilometers for one season or less during platform and pipeline construction. Some whales may also be excluded from feeding within a few hundred meters of drilling units and production platforms.

The oil spill assumptions for the Alaska Region do not change from Alternative I under this alternative and include one 30,000-bbl foreign tanker spill each off Washington, northern California, and southern California. It is assumed that oil not produced on the Pacific OCS will be replaced by imported oil, and that one tanker spill of 30,000 bbl of oil will occur in the Southern California Planning Area as a result of this substitution. The northern California spill is assumed to occur more than 80 km from the coast; the remaining three spills are assumed to occur within 80 km of the coast and contact the shoreline.

As in Alternative I, it is expected that the oil spills assumed to occur along the species' migratory pathway through the Alaska and Pacific Regions will result in no mortality and will not disrupt the gray whale migration.

Four of the 20,000-30,000 bbl oil spills are assumed to occur in the primary gray whale summer feeding grounds in the northern Bering and Chukchi Seas. As in Alternative I, the occurrence and contact of one such spill during the summer could result in the death of a few individuals and the displacement of animals from an area of up to 1,500 km^2 for all or part of a season.

CONCLUSION: The adoption of Alternative IV is expected to result primarily in sublethal effects on the gray whale population involving changes in abundance and distribution lasting a year or less. A few mortalities will occur due to oil spills. This level of mortality is not expected to be distinguishable from natural variability within the gray whale population. There is a 18 to 81 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the gray whales over the 30- to 35-year life of the proposal.

2) Pinnipeds

GUADALUPE FUR SEAL: Under Alternative IV, all the blocks being considered for future leasing in the Southern California Planning Area would be excluded from the Comprehensive Program. Therefore, impacts to resources in the Pacific Region under this alternative could only be due to the tankering of Alaskan and foreign oil.

As discussed for Alternative I (Section IV.D.1.a(3)) the very low densities of Guadalupe fur seals estimated to occur in southern California waters make it unlikely that more than a few individuals would be contacted and killed by a foreign tanker spill. Such a low level of mortality would be indistinguishable from natural variation in the fur seal population and is not expected to impede the species' recovery.

CONCLUSION: The adoption of Alternative IV is expected to have no discernable effect on the Guadalupe fur seal abundance or distribution.

3) Sea Otter (Pacific Population)

Under Alternative IV, all the blocks being considered for future leasing in the Southern California Planning Area would be excluded from the Comprehensive Program. Therefore, impacts to resources in the Pacific Region under this alternative could only be due to the tankering of Alaskan and foreign oil.

The oil spill assumptions for the Alaska and the Pacific Regions were described previously. An oil spill contacting the sea otter populations in the Pacific Region would result in mortality and temporary loss of habitat. Assuming a spill and contact to the California mainland range, up to 13 percent of the population could die, and recovery of the California sea otter population would take up to 3 years. Assuming a spill and contact to San Nicolas Island, the translocated sea otter population would probably be eliminated. Assuming a spill and contact to the Washington range, tens of otters would die, and recovery of the Washington sea otter population would possibly take more than 5 years.

CONCLUSION: Adoption of Alternative IV is expected to have lethal effects on sea otter populations in the Pacific Region. Sea otter mortality is expected to occur as the result of assumed oil spills; population recoveries will take 3 years or more. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

(b) Nonendangered Species

1) Cetaceans

a) Killer Whale

Under Alternative IV, potential impacts to killer whales from routine activities could occur only in the Alaska Region and are likely to decrease somewhat with the exclusion of the Pacific Region blocks, but not differ substantially from those discussed for Alternative I. These activities include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Section IV.D.1.a(3) provides a discussion of potential impacts on the killer whale population and an analysis of the impacts expected as a result of Alternative I. As in Alternative I, these activities are expected to have no measurable effects on the killer whale population.

The oil spill assumptions for the Alaska and the Pacific Regions were described previously. In the Pacific Region, no mortality is expected as a result of accidental oil spills; changes in killer whale numbers and distribution in areas contacted by a spill are expected to last less than 1 year. In the Alaska Region, accidental oil spills are expected to result in the death of a few killer whales in protected waters. This level of mortality is expected to be indistinguishable from normal variability in the killer whale population.

CONCLUSION: Adoption of Alternative IV is expected to result in killer whale mortality involving a few individuals. This level of mortality is expected to be indistinguishable from natural variability in the killer whale population. Accidental oil spills in the Alaska Region are the primary impacting factor. There is a up to 81 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal in the Alaska Region.

b) Harbor Porpoise

Under Alternative IV, potential impacts to harbor porpoises from routine activities could occur only in the Alaska Region and are likely to decrease somewhat with the exclusion of the Pacific Region blocks, but not differ substantially from those discussed for Alternative I. These activities include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Section IV.D.1.a(3) provides a discussion of potential impacts on the harbor porpoise population and an analysis of the impacts expected as a result of Alternative I.

Pipeline construction activities are expected to result in the displacement of harbor porpoises from a few square kilometers of nearshore habitat in Cook Inlet and the Gulf of Alaska for a period of several months.

The oil spill assumptions for the Alaska and the Pacific Regions were described previously. It is likely that part of the harbor seal population in the Gulf of Alaska or Washington would be exposed to at least one of the spills assumed to occur under this alternative. Assuming occurrence and contact, accidental oil spills are expected to result in the loss of a few harbor porpoises and the possible displacement of animals from the area of the spill for several months.

CONCLUSION: Adoption of Alternative IV is expected to result primarily in sublethal effects on harbor porpoises lasting less than 1 year. A few mortalities will result from accidental oil spills. No discernable changes in the species' abundance or distribution are expected.

2) Pinnipeds

a) Northern Elephant Seal

The oil spill assumptions for the Alaska and Pacific Regions were described previously. As discussed in Alternative I (Section IV.D.1.a(3)), a few elephant seal pups (less than 20) are expected to die if one of the spills assumed to occur off southern California contacts the elephant seal rookeries on San Miguel or San Nicolas Islands during the species' winter breeding season. This level of mortality would not be distinguishable from natural variability within the elephant seal population.

CONCLUSION: Although minor mortality (less than 20 pups) is expected due to accidental oil spills, adoption of Alternative IV is expected to result in no discernable changes in northern elephant seal abundance or distribution.

b) California Sea Lion

The oil spill assumptions for the Alaska and Pacific Regions were described previously. An oil spill contacting a California sea lion rookery during the species' summer breeding season would result in pup mortality. Assuming a spill during the summer and contact to one of the rookeries, it is possible that tens to hundreds of sea lion pups would die. Recovery of the California sea lion population from such a loss is expected to take 3 years or less.

CONCLUSION: Adoption of Alternative IV is expected to result primarily in sublethal effects on the California sea lion population. Some mortality (of tens to hundreds of pups) is expected to occur due to assumed oil spills. Population recovery will take no more than 3 years. No discernable changes in California sea lion distribution will occur. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from the tankering of OCS oil along the west coast over the 35-year life of the proposal.

d. Impacts on Terrestrial Mammals

(1) Gulf of Mexico Region

ALABAMA, CHOCTAWHATCHEE, AND PERDIDO KEY BEACH MICE: Accidental events such as oil spills and oil spill response activities may adversely affect Alabama, Choctawhatchee, and Perdido Key beach mice. It is assumed that one of the larger size class spill will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is expected that oil spills of any size class resulting from the proposal will not contact or affect Alabama, Choctawhatchee, and Perdido Key beach mice or their habitat due to their limited home range.

CONCLUSION: All impacts both positive and negative, associated with leasing offshore southeast Alabama and Florida would not occur. The acceptance of this alternative would therefore result in no effects on Alabama and Perdido Key beach mice nor their habitats.

(2) Alaska Region

CARIBOU: Under Alternative IV the areas adjacent to the adjacent to the Beaufort and Chukchi Seas used by caribou herds would be effected by the same level of routine activities and accidental events associated with Alternative I. Section IV.D.1.a(4) provides a discussion on the potential impact and those expected based on the level of activity assumed for Alternative I.

Oil spills from offshore and onshore activities associated with this proposal are expected to have little impact on caribou distribution, abundance, or reproduction, since few are likely to be contaminated by oil or ingest contaminated vegetation.

While foraging or seeking insect relief, caribou may contact, ingest and/or inhale oil that is stranded on beaches or released from onshore pipelines. Likewise, caribou may encounter refined petroleum products spilled along roads. Subsequent containment and cleanup operations in the vicinity of areas occupied by caribou are expected to result in disturbance and temporary abandonment of the affected areas.

CONCLUSION: Disturbance from construction and operation of facilities, as well as air and vehicle traffic, associated with Alternative IV is expected to cause displacement of portions of North Slope caribou herds with the animals avoiding substantial parts of the core calving areas for the life of the project. The resulting reduction in caribou distribution or abundance is not expected to require more than two generations for recovery. Oil spills are expected to have little impact on caribou.

e. Impacts on Marine and Coastal Birds

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect endangered and threatened birds. It is expected that OCS offshore flights will not disturb endangered and threatened birds because of prohibitions by MMS and adherence to FAA recommended minimum ceilings. It is expected that vessel traffic will not disturb endangered and threatened birds because it occurs in/out of existing port areas greater than one-half mile from critical habitats. It is expected that construction of pipeyards and terminals will not disturb or displace endangered and threatened birds because they will not be constructed in critical habitat within upland or wetland areas.

Accidental events such as oil spills and loss of trash and debris may adversely affect endangered and threatened birds. It is assumed that the combination of lessees obeying special MMS prohibitions and enactment of MARPOL, Annex 5, greatly reduces if not eliminates future OCS-related loss of trash and debris. The effect on endangered and threatened birds from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 birds. The effect on endangered and threatened birds from oil spills is expected to be primarily sublethal and less than one generation in duration with fewer than five deaths of the brown pelican and piping plover. All deaths of endangered and threatened birds affected by spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: As a result of this alternative, there will be no discernible decline in an endangered or threatened bird population or species, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges from 10 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Nonendangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect marine and coastal birds. OCS offshore helicopter flights will not disturb marine and coastal birds because of prohibitions by MMS and adherence to FAA recommended minimum ceilings. Vessel traffic will not disturb marine and coastal birds because it occurs in/out of existing port areas. The new pipeline landfalls and piping through coastal areas are estimated to affect 27 ha of marine and coastal bird habitat. It is expected that construction of pipeyards and terminals will not disturb or displace marine and coastal birds because they will be constructed in upland areas and not in wetlands. It is expected that pipeline landfalls will disturb and/or displace marine and coastal birds within and from, respectively, 27 ha of coastal area.

Accidental events such as oil spills and loss of trash and debris may adversely affect marine and coastal birds. It is assumed that one of the larger size class spill will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is estimated that the larger of these oil spills will contact and affect 50 km of beach, 25 km of inshore shoreline, and 16 ha of wetlands. It is estimated that small oil spills will contact and affect 100 ha of estuaries. Lethal effects are expected for no more than 100 birds from direct oiling.

Sublethal effects are expected for no more than 1,000 birds from contact with oil and contamination of food sources.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a marine or coastal bird population or species, and no change in distribution or abundance. Any affected individuals, by deaths or sublethal effects, will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil and the probability ranges from 10 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Alaska Region

(a) Threatened or Endangered Species

1) Arctic and American Peregrine Falcons

Based on the scenario for Alternative IV, noise and oil spills are expected to cause a decline in the species number of peregrine falcons that would last longer than 5 years. Alternative IV differs from Alternative I in that there are no exploration or production activities proposed for California. This would reduce the number of potential disturbances of arctic and american peregrine falcons that may be migrating through or over wintering in the California area. Since Alternative IV reduces these potential disturbances by about one third that of Alternative I, the effect of this alternative would be to reduce somewhat any adverse effects due to noise disturbance .

CONCLUSION: Based on the scenario assumptions, noise associated with Alternative IV is expected to lead to abandonment of up to 35 percent of the peregrine falcon nest sites, and cause a reduced rate (up to 35 percent) of reproduction. The assumed oil spills are estimated to indirectly affect up to 35 percent of the peregrine falcon population in Alaska and are estimated to result in up to 35 percent mortality. This decline in species numbers would last longer than 5 years.

2) Short-Tailed Albatross

Alternative IV differs from Alternative I in that there is no exploration or production activities projected in the southern portion of the short-tailed albatross's range (California). However, most short-tailed albatross sightings have been in the Gulf of Alaska or the southern Bering Sea area. Therefore, the effects associated with Alternative IV are estimated to be about the same as Alternative I. This would amount to noise disturbance, entanglement in debris, or consumption of plastics affecting about 2 percent of the albatross population each year. The majority of these effects would be sublethal.

Because Alternative IV assumes the same number of oil spills as Alternative I in the range of the short-tailed albatross, the estimated effects of oil on the short-tailed albatross are estimated to be similar to Alternative I. This would amount to lethal effects on a substantial number of feeding birds in the area of the spill. The overall decline in the species numbers would last longer than 5 years.

CONCLUSION: Based on the assumptions for Alternative IV, disturbance, entanglement in debris, and consumption of plastics is not expected to affect more than about 2 percent of the short-tailed albatross population. The majority of these effects would be sublethal. Oil spills associated with Alternative IV are estimated to lethally affect up to 25 percent of the population depending on the number of birds feeding in the area.

(b) Nonendangered Species

1) Bald Eagle (Alaska Population)

Routine activities and accidental events assumed to occur in the Alaska Region as a result of the adoption of Alternative IV have the same level of activity as Alternative I within the areas occupied by the Alaskan population of bald eagles. Impacts on bald eagles would be the same as Alternative I. Section IV.D.1.a(5) provides an analysis of the expected impacts.

CONCLUSION: Under Alternative IV, two assumed tanker spills in the Gulf of Alaska, where the bald eagle population is concentrated, are expected to cause mortality requiring a minimum of three generations (12 years) for recovery. Routine activities associated with development are expected to disturb fewer than 25 pairs of nesting eagles and require the equivalent of one generation for recovery of any loss in productivity. There is a 18 to 34 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the bald eagle over the 30-year life of the proposal.

2) Waterfowl

DIVING DUCKS: Aircraft and vessel support operations and construction activities are the most likely sources of routine disturbance that could affect distribution and abundance of overwintering diving ducks in the California area. Oil spills are expected to result in lethal effects if they contact diving ducks and may cause adverse impacts if prey availability is affected. Subsequent containment and cleanup operations in the vicinity of diving duck concentrations are likely to result in disturbance and abandonment of the affected areas for the duration of the activity.

Routine disturbance under Alternative I is expected to have little impact on diving ducks, requiring less than a generation for recovery, due to their concentration away from intensive OCS activities and small proportion of their large populations likely to be exposed to such activities. Thus, removal of the southern California sale from the program is expected to result in a minor reduction of impact from Alternative I.

It is assumed that by deleting the southern California sale from the program a portion of the oil and gas forgone will be replaced by oil imported into California. Based on the amount of replacement imports, it is assumed that one 30,000 bbl foreign tanker spill will occur offshore southern California. This tanker spill poses a greater environmental risk than the pipeline spill assumed for the proposal. In particular, bays, marshes and nearshore waters are expected to be at greater risk from a tanker spill than a pipeline spill. Overall oil spill impact on North Pacific diving duck populations is expected to be similar to that estimated for Alternative I, requiring no more than one generation for recovery, because of their large populations concentrated in many areas to the north and substantial reproductive potential.

CONCLUSION: Routine disturbance impacts on diving ducks under this Alternative IV are expected to be similar to Alternative I, requiring less than one generation for recovery. Oil spill impacts are expected to be similar to Alternative I for the North Pacific population, requiring no more than one generation for recovery to its original status.

GEESE: Aircraft and vessel support operations and construction activities are the most likely sources of routine disturbance that could affect distribution and abundance of overwintering Pacific black brant, the only goose species of those considered occupying marine waters, in the California area. Oil spills are expected to result in lethal effects if they contact brant and may cause adverse impacts if forage availability and quality is affected. Subsequent containment and cleanup operations in the vicinity of brant concentrations are likely to result in disturbance and abandonment of the affected areas for the duration of the activity.

Routine disturbance under Alternative I is expected to have little impact on the brant population, requiring less than a generation for recovery, due to their concentration in Mexican waters well to the south of intensive OCS activities and small proportion of their population occupying California waters. Thus, removal of the southern California sale from the program is expected to result in a minor reduction of impact.

It is assumed that by deleting the southern California sale from the program a portion of the oil and gas forgone will be replaced by oil imported into California. Based on the amount of replacement imports, it is assumed that one 30,000 bbl foreign tanker spill will occur offshore southern California. This tanker spill poses a greater environmental risk than the pipeline spill assumed for the proposal. In particular, bays, marshes and nearshore waters are expected to be at greater risk from a tanker spill than a pipeline spill. Overall oil spill impact on the brant population is expected to be similar to that estimated for Alternative I, requiring no more than one generation for recovery, because of the relatively small overwintering population in the California area.

CONCLUSION: Routine disturbance impacts on brant under Alternative IV are expected to be similar to Alternative I, requiring less than one generation for recovery. Oil spill impacts are expected to be similar to Alternative I for the brant population, requiring no more than one generation for recovery to its original status.

(3) Pacific Region

(a) Threatened or Endangered Species

1) Bald Eagle (Pacific Population)

If Alternative IV, Exclude Planning Areas, were selected, none of the routine activities or accidental events assumed to result from actions proposed under Alternative I for the Southern California Planning Area would occur. However, accidental tanker spills from proposed actions in the Alaska OCS Region and foreign imports are still assumed to occur in the Pacific OCS Region.

It is assumed that by deleting the southern California sale from the program a portion of the oil and gas forgone will be replaced by oil imported into California. Based on the amount of replacement imports, it is assumed that one 30,000 bbl tanker spill will occur offshore southern California. This tanker spill poses a greater environmental risk than the pipeline spill assumed for the proposal.

Proposed development in Alaska is also assumed to result in a 30,000 bbl tanker oil spill in the Southern California Planning Area due to projected tankering of Alaskan oil.

The generic discussion of the possible impacts of accidental oil spills on bald eagles is presented in Section IV.A. Based on the impacts of the *Exxon Valdez* oil spill on the Prince Williams Sound population of bald eagles in Alaska (see Section IV.A), an oil spill along the coast of southern California related to this proposal could result in eagle mortality. However, due to the extreme rarity of this species along the southern California coast, an oil spill is not expected to impact this species.

A small population (roughly 60-70 pairs) of eagles occurs year-round along the coast of Washington, and a portion of this population could potentially be at risk from a tanker spill. If a tanker spill were to contact the Washington shore or if marine birds and/or mammals were oiled and washed ashore, some eagles could be oiled and death could occur. The magnitude of expected eagle mortality would vary with a number of factors, including time of year, volume of oil spilled, wind speed and direction, current speed and direction, distance of spill from shore, and location of spill in relation to eagle populations. Given the analytical assumptions identified for the proposed action, tens of eagles are expected to be lost as a consequence of a spill contacting the Washington coast. Because of the relatively slow population growth rates of bald eagles, recovery in this area could take up to 4 years.

Because of the distance from shore of the assumed spill off northern California (50 miles), an Alaskan tanker spill in this area is not expected to have an impact on bald eagles.

CONCLUSION: Under Alternative IV, the only impacting agent on bald eagles in the Pacific OCS Region is oil from assumed tanker spills. Accidental tanker oil spills assumed to occur as a result of Alternative IV in the Southern California Planning Area are not expected to have an impact on threatened or endangered populations of bald eagles. An Alaskan tanker spill of 30,000 bbl off the coast of Washington is expected to result in injury and mortality of bald eagles. Assuming a spill contacted the Washington shoreline, tens of eagles are expected to be lost, with recovery taking up to 4 years. There is up to a 81 percent probability one or more spills of 10,000 bbl or greater from the transportation of OCS oil along the west coast over the 35-year life of the proposal.

2) California Least Tern

As with most birds, California least terns are vulnerable to the effects of oil contact. A generic discussion of the possible impacts of accidental oil spills on least terns is presented in Section IV.A. If the assumed tanker spill were to contact a least tern colony from May to September, some mortality of adults and some disruption of reproduction is expected. Because of the wide spacing of tern colonies, only one colony should be affected by any single event. Depending on various factors (spill date, spill size, weather, distance from shore), the impact on a colony could range from the loss of a few adults to the loss of an entire colony. Given the size of the tern colonies at risk (see Section IV.D.1.a(5)), no more than 50 pairs or about 5 percent of the population would be affected. However, historically, tern populations have increased only very slowly, and recovery from the loss of more than a few individuals is expected to take 2-4 years, depending on how severely a colony is affected.

CONCLUSION: Under Alternative IV, assuming oil contact with California least tern, injury and mortality of adults are expected to occur, with corresponding disruptions in reproduction and loss of young. No more than one tern colony is expected to be affected by any single event. Expected outcome of spill contact with a tern colony are losses of up to 50 pairs (5% of the population) and the complete disruption of the colony's reproductive cycle for that year. Because of the very slow rate of change in least tern population size in the last 15-20 years, recovery is expected to take 2-4 years. Assuming a spill contacted the Washington shoreline, tens of eagles are expected to be lost, with recovery taking up to 4 years. There is up to a 81 percent probability one or more spills of 10,000 bbl or greater from the transportation of OCS oil along the west coast over the 35-year life of the proposal.

3) California Brown Pelican

A generic discussion of the possible impacts of accidental oil spills on California brown pelicans is presented in section IV.A. Because this species forages at sea and sometimes rests on the water, brown pelicans could potentially be vulnerable to the effects of spilled oil. In addition, brown pelicans are often concentrated in nearshore waters, conceivably exposing numerous individuals to a given oil spill. The most serious potential impact of direct contact of oil on brown pelicans is the effect on thermoregulation.

If a tanker spill were to contact the Channel Island breeding colonies during spring or summer, perhaps as many as 1,000 adult pelicans could be oiled, with mortality ranging from 20-50 percent of birds contacted. Besides direct mortality, major disruptions in reproduction could be expected, with the potential loss of up to 25 percent of active nests. The overall effect of such a spill on pelican populations could be expected to last for 2-4 years (depending on food availability during the recovery period). At other times of year or if breeding colonies were not contacted, the impact of a 30,000 bbl oil spill would be much less, with only 100-500 birds possibly contacted and recovery within 2 years. Oil spills from Alaskan tankers in other planning areas within the Pacific Region are only expected to have an impact on brown pelicans during late summer and early fall, when pelicans disperse northward. although not expected, a 30,000 bbl foreign tanker spill during this short period could contact a few individuals with some mortality.

CONCLUSION: Under Alternative IV, from 100 to 1,000 brown pelicans are expected to be oiled, with mortality occurring in 20 to 50 percent of those contacted; recovery is expected in 2 to 4 years. There is up to a 81 percent probability one or more spills of 10,000 bbl or greater from the transportation of OCS oil along the west coast over the 35-year life of the proposal.

4) Light-Footed Clapper Rail

As with most birds, light-footed clapper rails are vulnerable to the effects of oil contact. Since light-footed clapper rails seasonally breed in about 14 widely-spaced marshes from Santa Barbara to the Mexican border (USDOI, FWS, 1980b), an oil spill would have to occur and contact the birds at one of these sites. This is considered unlikely, however, as protective equipment (e.g., oil booms) is readily available throughout the rail's range, and oil can generally be prevented from entering estuaries and marshes. Nevertheless, if an oil spill should occur and contact a rail marsh, some mortality is expected. Depending on various factors (spill date, spill size, weather, distance from shore), the impact on light-footed clapper rails could range from a few individuals to the loss of this species from an entire marsh. Due to the continued depressed population of this species, the loss of more than a few individuals could be significant, requiring from 2 to as much as 6 or 7 years to recover.

CONCLUSION: Alternative IV is not expected to have an impact on light-footed clapper rails.

(b) Nonendangered Species

1) Seabirds

Under Alternative IV, routine activities and accidental events for the Alaska Region are the same as in Alternative I and is discussed in Section IV.D.1.a(5). Also under this alternative, none of the routine activities or accidental events assumed to result from actions proposed under Alternative I for the Southern California Planning Area would occur. However, accidental tanker spills from proposed actions in the Alaska OCS Region are still assumed to occur in the Pacific OCS Region. Since the routine activities in Southern California would be eliminated, western gulls and pigeon guillemots nesting along the southern California coast are not expected to be disturbed.

If an oil spill of 1,000 bbl or more occurred, it would cause substantial (up to 70%) reduction in local populations of some seabirds. The seabirds most likely to suffer direct mortality from oil spills are auklets, murres, and other species of alcids. Alcids, especially murres, form large concentrations on the water both at their breeding colonies and their wintering areas, and they have suffered heavy mortality from oil spills (e.g., in the Barren Islands from the *Exxon Valdez* spill). The reproductive strategy of murres and other alcids having a low reproductive output combines a long lifespan with a long period to reach reproductive maturity. Such a strategy allows them to cope with adverse environmental fluctuations, but also makes the species slow to recover from additional man-induced mortalities such as oil spills. Effects requiring more extended recovery periods also are expected to result when species with small or declining regional populations, or restricted distribution, experience substantial mortality following an oil spill. Likewise, contact of a population with more than one spill, especially within a period of one or two generations, is expected to extend recovery periods.

In general, the size of an oil spill may be less important than the actual location of the oil spill. Substantial mortality is expected to result from a spill during migration and breeding periods when seabirds are concentrated near their breeding colonies.

Associated with the Alternative IV, there is a risk that oil spills could occur and contact migratory seabirds in both the Alaska and Pacific Regions. While many seabirds do not undertake extensive migration, most annually occupy more than one OCS planning area and, therefore, could be subject to increased oil-spill risk.

Oil-spill impacts on most seabirds (arctic terns and glaucous gulls) breeding on Beaufort and Chukchi Sea barrier islands are expected to require at least one generation for recovery, although their regional populations are sufficiently numerous and widespread that overall recovery periods will be shorter. Impact of an oil spill on the small black guillemot population, with its extremely limited distribution in these two areas, is expected to require more than one generation for recovery to its former status. Murres and other seabirds occupying major (100,000+) colonies located at Capes Lisburne and Thompson in the Chukchi Sea, although vulnerable while rafting in large groups on the water during prenesting and nesting periods, are expected to experience impacts requiring no more than one generation for recovery as a result of the extremely low probability of contact by an oil spill. Likewise, thousands of molting least and crested auklets present in the Bering Strait during the fall would be vulnerable to any oil spill, but no spills are expected to contact this area.

During the winter and spring seasons, seabirds occupying open-water habitat in the vicinity of St. Matthew and Hall Islands in the central Bering Sea are vulnerable to a spill occurring in the Navarin Basin. However, spill trajectories trend away from the islands, and thus any impacts during this period are expected to require no more than one generation for recovery. During the breeding season, however, when large numbers (1 million+) of seabirds are present, the probability of a spill contacting this area is substantial, particularly as a result of tanker transport, and impacts on these populations (potential losses 50,000+) are expected to require several generations for recovery. Likewise, while the vulnerability of the immense populations of seabirds nesting on the Pribilof Islands is considerable, risk of spill contact is slight, and thus any impact resulting from an oil spill is expected to require no more than one generation for recovery. As a result of the probability of spill contact (tanker) and high bird densities during the nesting season, seabird populations in the eastern Aleutian-Unimak Pass area, including especially the large proportion of the world tufted puffin population, are expected to sustain losses requiring several generations for recovery to their original status. Likewise, the high densities of overwintering seabirds in this area lead to the expectation that oil-spill impacts will require several generations for recovery. Immense flocks of nonbreeding southern-hemisphere shearwaters occur here and elsewhere in Alaskan waters in spring, summer, and fall; however, because of the vast world population, any losses sustained by contact of such flocks with an oil spill are not expected to require more than one generation for recovery.

In the Gulf of Alaska, coastal oil spills from tankers serving Gulf of Alaska or Cook Inlet lease areas or the TAP terminal are expected to contact one or more major colony areas (Semidi Islands, Sandman Reefs, Barren Islands, Forrester Island) as well as many of the numerous smaller colonies in the Shumagin Islands, Kodiak archipelago, Kenai Peninsula area, and southeast Alaska in the prenesting or nesting periods, resulting in losses that would require several generations for recovery. During the nonbreeding season, overwintering seabird populations are not expected to sustain losses from contact with oil spills requiring more than one generation for recovery.

An oil spill in winter in the Chukchi or northern Bering Seas would most likely be incorporated into the ice to be released in the spring or later and could impact thousands of breeding and foraging seabirds at that time as the equivalent of an additional spill. Because most seabirds migrate south with the onset of ice formation, they also could be exposed to oil spills in the southern Bering Sea, Unimak Pass, and/or Gulf of Alaska during the nonbreeding season—thereby potentially experiencing greater impacts than discussed above, or experiencing them with greater certainty. Seabirds occupying pelagic waters are not expected to be present in sufficiently high densities to require more than one generation for recovery from any losses sustained by contact with an oil spill.

In the Washington/Oregon area, four major colonies and several smaller ones would experience mortality of hundreds to several thousand in the event of a tanker spill in the vicinity, which may require one or more generations for recovery.

It is assumed that oil not produced on the Pacific OCS will be replaced by imported oil, and that one tanker spill of 30,000 bbl of oil will occur in the Southern California Planning Area as a result of this substitution. It is assumed that this spill will occur within 80 km of the coast and contact the shoreline. Likewise, a tanker spill near a major California colony area (e.g., Castle Rock, Farallon Islands, Channel Islands) when breeding birds are present is expected to cause major losses and require several generations for recovery.

CONCLUSION: Oil spills assumed for Alternative IV are expected to result in losses to breeding seabird populations during prenesting and nesting periods throughout much of the Alaska Region and south to California requiring several generations for recovery to the initial population status. During the nonbreeding period, any losses resulting from oil-spill contact are expected to require no more than one generation for recovery except in the eastern Aleutian-Unimak Pass area, where several generations would be required. Disturbance effects from routine activities are expected to take less than one generation for recovery. The probability of one or more spills of 10,000 bbl occurring over the 30- to 35-year life of the proposal ranges from 18 to 81 percent.

2) Shorebirds

Under Alternative IV, potential impacts to shorebirds from routine activities could occur only in the Alaska Region and are likely to decrease somewhat with the exclusion of the Pacific Region blocks, but not differ substantially from those discussed for Alternative I. These activities include air traffic, pipeline landfalls, and construction of onshore facilities. Section IV.D.1.a(5) provides a discussion of potential impacts on shorebirds and an analysis of the impacts expected as a result of Alternative I.

Air traffic in the Alaska OCS Region is expected to cause disruptions in reproduction of local (i.e., within 0.5 km of flight paths) shorebird populations, with recovery expected within 1 year. Impacts to shorebirds can be reduced by restricting air traffic and onshore developments from important shorebird use areas (nesting and staging).

Within the Alaska OCS Region, the construction of pipeline landfalls and onshore facilities is expected to be at the same level of activity as Alternative I. Pipeline landfalls are expected to cause the displacement of shorebirds from the area immediately adjacent to the construction (within a few hundred meters) for about 6-8 weeks. Construction of onshore facilities could result in displacement of shorebirds within about 0.5 km of construction and the loss of about 10-15 hectares of habitat from each planning area. A temporary (i.e., less than 1 year) reduction in local productivity may result if nesting habitat were lost to construction. Because of the widespread distribution of most shorebird species in Alaska and the very small amount of habitat potentially affected, however, construction activities are not expected to cause a long-term (i.e. 1 year), measurable impact to shorebird populations. Existing legislative constraints and permitting procedures would serve to further minimize these localized effects.

It is assumed that by deleting the southern California sale from the program a portion of the oil and gas forgone will be replaced by oil imported into California. Based on the amount of replacement imports, it is assumed that one 30,000 bbl tanker spill will occur offshore southern California. This tanker spill poses a greater environmental risk than the pipeline spill assumed for the proposal.

Proposed development in Alaska is also assumed to result in a 30,000 bbl tanker oil spill in the Southern California Planning Area due to projected tankering of Alaskan oil. As with most birds, shorebirds are vulnerable to the effects of oil contact. A generic discussion of the possible impacts of accidental oil spills on shorebirds is presented in Section IV.D.1.a(4). In southern California (a shorebird wintering area) shorebirds are most common along the coast from August through March. If a large oil spill were to contact a sandy beach, where shorebirds are relatively less common during that period, a relatively few seabirds would probably be killed. However, if an estuary or marsh, where shorebirds are usually more abundant, were contacted, mortality would probably be much higher involving several hundred birds.

The impact of most oil spills assumed for the Alaska OCS Region under Alternative IV is expected to be similar to those for the Southern California Planning Area as discussed for Alternative I. However, a few areas along the Alaskan coast stand out as being of particular importance to shorebirds, including the North Slope along the shores of the Arctic Ocean (an important shorebird breeding and staging area), the Yukon-Kuskokwim River Delta, and the Seward Peninsula-Copper River Delta region. Because of the higher shorebird densities found in these areas, the effect of a spill contacting one of them could be greater than with spills in other areas.

Oil spill contact with North Slope shorebird populations would most likely originate from a pipeline spill of 25,000 bbl assumed for the Chukchi Sea Planning Area. If a pipeline or platform spill were to contact the North Slope shoreline from May through September, from a few hundred to a few thousand shorebirds could be affected. Because of the high reproductive potential of most shorebird species, populations should recover in 1-2 years.

The Yukon-Kuskokwim River Delta region is located mostly within the St. Matthew-Hall Planning Area, and no lease sales are proposed for that planning area. However, a tanker oil spill of 30,000 bbl assumed to occur from proposed development in the Norton Basin Planning Area, which is located just north of St. Matthew-Hall, could contact the northern portion of the Delta. If a tanker spill in the Norton Basin Planning Area were to contact the northern Delta, a few thousand shorebirds could be affected, with recovery occurring in 1-3 years.

The Seward Peninsula-Copper River Delta region would most likely be affected by a tanker spill assumed to occur in the Gulf of Alaska Planning Area from proposed development in the Chukchi Sea Planning Area and by a tanker spill assumed to occur in the Gulf of Alaska Planning Area. If a tanker spill were to contact the Seward Peninsula coastline or the Copper River Delta from May through September, a few hundred to a few thousand shorebirds could be affected, with recovery occurring in 1-2 years.

Oil spills assumed for other Alaska OCS Region planning areas are either not expected to contact shore (30,000 bbl tanker spill in the Navarin Basin Planning Area) or are expected to affect no more than a few hundred shorebirds with recovery occurring in less than 1 year (see Section IV.A).

CONCLUSION: Under Alternative IV, no impacts on shorebirds from routine OCS-related activities will occur in the Pacific OCS Region. Impacts from air traffic in the Alaska OCS Region are expected to include disturbance of local (i.e., within 0.5 km of flight paths) shorebird populations with some local reductions in productivity, and recovery occurring within 1 year. Construction activities assumed for the Alaska OCS Region are not expected to cause a measurable impact to shorebird populations, although a temporary reduction in productivity within 0.5 km of construction is expected.

Assuming oil contact with the shoreline in the Pacific Region, injury and mortality of shorebirds are expected to occur, involving a few to as many as 500 individuals, with recovery occurring in 1-2 years. Within the Alaska OCS Region the impact of assumed oil spills on shorebirds is expected to range from less than 100 to a few. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS oil tankered along the west coast over the 35-year life of the proposal. There is an 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal in the Alaska Region.

f. Impacts on Fish Resources

(1) Gulf of Mexico Region

(a) Gulf Sturgeon

Accidental events such as oil spills may adversely affect Gulf sturgeon. It is assumed that one of the larger size class spill will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas. Numerous small spills are assumed to occur and disperse rapidly along a stretch of coast extending from western Mississippi to eastern Texas. Less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. This oil spill will contact and affect 16 ha of estuaries. The small oil spills will contact and affect 100 ha of estuaries. It is assumed that oil spills (1,000 bbl or more) will not contact Gulf sturgeon due to their limited home range. Only sublethal effects on Gulf sturgeon are expected from contact with small oil spills.

CONCLUSION: As a result of Alternative IV, the effect on Gulf sturgeon is expected to be undetectable and recovery from any sublethal effects will require less than one year.

(b) Other Fish Resources

A number of routine events such as operational discharges, structure removals, and seismic surveys may adversely affect fish resources. It is assumed that offshore discharges of drilling muds and produced waters will rapidly dilute to background levels and not affect fish resources. Lethal effects to demersal species resulting from explosive platform removals would occur up to 50 m from the detonation site and sublethal effects to fish with internal air chambers extend to 150 m. It is assumed that only airguns will be used in seismic surveys as a result of the proposed action and not affect fish resources.

Accidental events such as oil spills and subsurface blowouts may adversely affect fish resources. It is assumed that one of the larger size class spill will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. This spill will contact and affect 16 ha of estuaries; whereas, the smaller oil spills will contact and affect 100 ha of estuaries. Both lethal and sublethal effects on fish resources are expected from oil spills. It is estimated that a total of 21 subsurface blowouts will occur and assumed that blowouts cause lethal effects on fish resources within 50 m and sublethal effects within 150 m of the blowout site.

CONCLUSION: As a result of this alternative, the effect on fish resources is expected to be undetectable to estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters, to pelagic species such mackerels, cobia, bluefish, amberjack, and dolphin fish, and to reef fish species such as grouper, snapper, gag, scamp, and seabass. Any loss of fish resources will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil, and the probability ranges from 10 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Alaska Region

(a) Pacific Salmon (Alaska Population)

Because the scenario for Alternative IV is the same as Alternative I in areas within the range of Pacific Salmon, effects on these species as the result of the adoption of Alternative IV would be as discussed for Alternative I.

CONCLUSION: Routine activities assumed for Alternative IV are expected to have no measurable effect on salmon. Oil spills contacting migratory salmon populations could have adverse impacts on small segments of these fish. The numbers so affected would be small in proportion to the total; and any oil spill would have only a small-scale, small-area, and short-time effect. There is an 18 to 34 percent chance of one or more spills of 10,000 bbl or greater occurring throughout the pelagic range of migratory salmon over the 30-year life of the alternative.

(b) Walleye Pollock

Because the scenario for Alternative IV is the same as Alternative I in areas within the range of Walleye Pollock, effects on these species as the result of the adoption of Alternative IV would be as discussed for Alternative I.

CONCLUSION: The level of oil and gas exploration/development for Alternative IV is not expected to have an appreciable effect on groundfish populations.

(c) Arctic Cisco

Because the scenario for Alternative IV is the same as Alternative I in areas, effects on these species as the result of the adoption of Alternative IV would be as discussed for Alternative I.

CONCLUSION: Based on the assumptions for Alternative IV, no appreciable adverse effects are expected for arctic cisco in the Alaska Region.

(d) Other Fish Resources

Because the scenario for Alternative IV is the same as Alternative I in areas, effects on these species as the result of the adoption of Alternative IV would be as discussed for Alternative I.

CONCLUSION: The level of oil and gas exploration/development activity assumed for Alternative IV is not expected to have an appreciable effect on other finfishes of the Alaska Region.

(3) Pacific Region

(a) Pacific Salmon (Pacific Population)

If Alternative IV, Exclude Additional Planning Areas, were selected, none of the routine activities or accidental events assumed for the proposed action in the Pacific Region would occur.

If this alternative is adopted, impacts from normal development activities will not occur. In Alternative I, impacts to Pacific salmon populations within southern California from normal OCS activities associated with the proposed action would be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels.

The life-history stages of Pacific salmon stocks most sensitive and vulnerable to oil exposure are outmigrating smolts, nearshore feeding juveniles, and adults that are beginning to ascend their home rivers to spawn. In two of three of these sensitive phases, oil must enter the mouth of a river estuary to cause an impact. Dilution, weathering, and containment would reduce the chance of disturbance in spawning streams from spills. Further, as described in the EISs for POCS Sales 73 and 80 (USDOI 1983b; 1983c), MMS Lease Stipulation 9 (oil spill response requirements) and indirectly Stipulation 10 (Testing of oil spill containment equipment) would be implemented as a committed mitigation measure of the proposed action which should further reduce the chance of a spill reaching a river mouth and causing impacts. Since river estuaries in southern California are rare, generally have narrow openings and are frequently closed off from the ocean for part of the year, it is unlikely the spill would enter and cause impacts. The assumption, therefore, is that oil will contact salmon while in the ocean.

Since salmon stock are small in Southern California and are migratory with limited time in a given ocean area, the probability of being contacted by the oil spill for an extended period of time is very low. A spill, either offshore or coastal, would contact only a small portion of the pelagic salmon habitat. Salmon may be able to detect some hydrocarbons in the water and divert from these contaminated areas. The most critical periods for exposure to oil, would be when a spill occurs along the spawning migration route or at the mouth of spawning streams; diversion from the spill could affect the spawning success of that population.

Thus, as with Alternative I (Section IV.D.1.a(6)), it is expected that the oil spill (1,000 bbl or more) assumed to occur in the Southern California Planning Area is expected to contact salmon in the ocean and result in lethal (less than ten percent) or sublethal effects that would not be discernible from natural variations of salmon typical of the area.

CONCLUSION: Adoption of Alternative IV is expected to result in lethal (less than ten percent) or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon.

(b) Steelhead Trout

If Alternative IV, Exclude Planning Areas, were selected, none of the routine activities or accidental events assumed for the proposed action in the Pacific Region would occur.

The life-history stages of steelhead stocks most sensitive and vulnerable to oil exposure are outmigrating smolts, nearshore feeding juveniles, and adults that are beginning to ascend their home rivers to spawn. Dilution, weathering, and containment would reduce the chance of disturbance in spawning streams from both spills. Further, as described in the EISs for POCS Sales 73 and 80 (USDOI, MMS, 1983b; 1983c), MMS Lease Stipulation 9 (oil spill response requirements) and indirectly Stipulation 10 (Testing of oil spill containment equipment) would be implemented as a committed mitigation measure of the proposed action which should further reduce the chance of a spill from reaching a river mouth and causing impacts. Since river estuaries in southern California are rare, generally have narrow openings and are frequently closed off from the ocean for part of the year, it is unlikely the spill would enter and cause impacts. However, since such an event is possible, it is assumed that a tanker spill will contact steelhead in streams during the spawning or outmigrating period as well as while they are in the ocean.

Since steelhead are migratory with limited time in a given ocean area, the probability of being contacted by an oil spill for an extended period of time is very low. A spill of 1,000 bbl or more would contact only a small portion of the pelagic steelhead habitat.

The impacts to southern California steelhead populations from the large oil spill are generally expected to be localized due to the relatively few and widely separated steelhead streams in the planning area. Steelhead streams in southern California are restricted to San Luis Obispo County. Since steelhead produced in any year generally spend from 2-4 years at sea maturing before returning to spawn, the greatest decline in abundance of spawning runs or populations affected by an oil spill is expected to be spread over a period of 2-4 years following the spill.

Oil spill impacts in the Alternative IV scenario are expected to be the same as for Alternative I, although, because the volume of the additional tanker spill increases the total volume of oil spilled, the chance of causing impacts from oil spills is increased slightly. Thus, as with Alternative I (Section IV.D.a.1(6)), it is expected that the oil spill assumed to occur in the Southern California Planning Area will affect trout either in spawning streams or while they are offshore. Since only a small portion of the population would be contacted by the spill, impacts from a contact with the oil spill offshore is expected to result in lethal or sublethal effects that would not be discernible from natural variations of steelhead populations typical of the area.

The tanker oil spill contacting the entrance of a steelhead stream in San Luis Obispo County, would result in a moderate reduction of 10-20 percent of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regional impacts would be less, since not every stream would be affected and would not be discernible from natural variations of steelhead trout populations within the area.

This alternative would not change the minor impacts which would not be distinguishable from natural population fluctuations, if impacts were to occur at all from oil spills in Alaska.

CONCLUSION: Adoption of Alternative IV is expected to result in the tanker oil spill contacting the entrance of a steelhead spawning stream in San Luis Obispo County, resulting in a reduction of 10-20 percent of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regional impacts would not be discernible from natural variations of steelhead trout populations within the area.

(c) Pacific Whiting

If Alternative IV, Exclude Additional Planning Areas, were selected, none of the routine activities or accidental events assumed for the proposed action in the Alaska and Pacific Regions would occur.

It is assumed that oil not produced on the Pacific OCS will be replaced by imported oil, and that one foreign tanker spill of 30,000 bbl of oil will occur within 80 km (50 miles) of shore within the Southern California Planning Area as a result of this substitution.

If this alternative is adopted, impacts from normal development activities will not occur. In Alternative I, the impacts to Pacific whiting populations within southern California from normal activities associated with the proposed action are expected to be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels.

Whiting eggs and larvae are widely distributed throughout southern California, occur primarily offshore rather than in nearshore waters, and are most abundant at depths well below the water surface (approximately 50 m). It is highly unlikely that an oil spill in southern California would contact and impact a substantial portion of these sensitive life stages. Pelagic juvenile and adult whiting also occur throughout southern California, but neither a substantial portion of the subpopulation nor its prey are likely to come into contact with the oil spill, since they normally occur at depths well below the water surface (90-100 m in daytime to 20-40 m at night) and are widely dispersed offshore. Possibly effective in further preventing impacts a mile or more from the spill would be the process of dilution, weathering, and containment of oil spills.

Oil spill impacts in the Alternative IV scenario are expected to be the same as for Alternative I, although, because the volume of the additional tanker spill increases the total volume of oil spilled, the chance of causing impacts from oil spills is increased slightly. Thus, as with Alternative I (Section IV.D.1.a(6)), it is expected that the oil spill assumed to occur in the Southern California Planning Area is not expected to cause measurable reductions in the abundance of the whiting population.

The alternative would not change the minor impacts which would not be distinguishable from natural population fluctuations, if impacts were to occur at all from oil spills in Alaska.

CONCLUSION: Adoption of Alternative IV is expected to result in lethal or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

(d) Other Fish Resources

As described in Alternative I (Section IV.D.1.a(11)) the tanker spill is expected to cause some local fish populations to experience sufficient egg and larvae mortality to result in a temporary population decrease, requiring at least one full breeding cycle to recover to its pre-spill size. On a regional level, the effects of spill on fish populations are expected to be inconsequential. Spill caused mortalities are expected to be indistinguishable from natural fluctuations of population numbers.

A tanker spill during the winter or spring which contacted one or more dense spawning schools of anchovy, herring or squid could directly affect local populations, possibly killing enough individuals within the affected area to cause a measurable reduction (less than 10%) in the regional population size. Locally, particularly in densely populated shallow near-shore areas, predator species could experience a slight decline in population size as a response to the change in the availability of these forage species. Impacts to local anchovy, herring and squid populations are likely to be temporary (less than two years) as replacement stock will arrive quickly from abundant and mobile stocks from unaffected areas of the region. Regional predator populations would not change noticeably.

CONCLUSION: Adoption of Alternative IV is expected to result in lethal (less than 10%) or sublethal effects locally in the Pacific Region. Recovery of affected local populations would occur within 2 years. Regionally, lethal or sublethal effects would not be discernible from natural variations of fish populations within the area.

g. Impacts on Reptiles

(1) Gulf of Mexico Region

A number of routine events such as anchoring, structure installation, pipeline placement, dredging, operational discharges, vessel traffic, and explosive platform removals may adversely affect threatened endangered marine turtles. It is expected that effects on marine turtles from anchoring, structure installation, pipeline emplacement, dredging, and operational discharges will be indistinguishable from the long-term (25-50 years) natural variability within populations of marine turtles. It is expected that marine turtles will avoid 5-10 m^2 of live bottom areas for up to a month and that this avoidance of impoverished foraging areas will have no effect on marine turtles. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of marine turtles to visually locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. The effects on marine turtles from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on marine turtles beyond 50 m of the detonation of a short-term nature lasting less than one week. No deaths are expected due industry's compliance with MMS guidelines for explosive removals.

Accidental events such as OCS-related trash and debris, oil spills, and oil spill response activities may adversely affect marine turtles. The effect on marine turtles from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 turtles. The effect on marine turtles from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation. It is expected that the effects from oil spill response activities would be sublethal to marine turtles causing avoidance of 116 ha of oiled coastal areas for one month.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a marine turtle population or species, and no change in distribution or abundance. Any mortalities will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges from 10 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Pacific Region

Under Alternative IV, all the blocks being considered for future leasing in the Southern California Planning Area would be excluded from the Comprehensive Program, while the proposed action for the Alaska region remains unchanged. Therefore, impacts to resources in the Pacific Region under this alternative could only be due to the tankering of Alaskan and foreign oil.

The oil spill assumptions for the Alaska and Pacific Regions were described previously. Section IV.D.1.a(7) provides a discussion of potential impacts on sea turtles and an analysis of the impacts expected as a result of Alternative I. As discussed in Alternative I, the very low sea turtle densities in the areas affected (particularly north of Point Conception) make it unlikely that these animals would be affected by the assumed spills; it mortality does occur, it is not expected to be distinguishable from natural variability within the species' populations.

CONCLUSION: Adoption of Alternative IV is expected to have no discernable effect on sea turtle abundance or distribution.

h. Impacts on Coastal Habitats

(1) Gulf of Mexico Region

(a) Wetlands and Estuaries

Impacts from accidental discharges of oil could affect approximately 100 ha of wetlands, mainly along the western Louisiana to eastern Texas coasts. In the areas affected, damage to wetlands will include temporary die back of the above ground vegetation, some complete plant mortality, and accelerated rates of land loss (the conversion of wetlands to open water). The disposal of OCS produced waters in coastal Louisiana is not expected to affect adjacent wetland areas based on the results of field studies. New dredging and construction projects in wetland areas include pipeline landfalls, navigation channel maintenance dredging and deepening, and new infrastructure construction. The four new pipeline landfalls are expected to affect 27 ha of wetlands. Maintenance dredging and deepening of navigation channels will affect wetlands mainly in coastal Louisiana where wetlands typically fringe navigation routes. In addition, the use of channels by OCS vessels will result in accelerated erosion of as much as 30 ha of wetland fringed channel banks. The construction of one new pipe yard and three new terminals is projected to occur along the south Texas and Alabama coasts where ample amounts of upland occur near the coast. Given the current regulatory environment, it is likely that these facilities will be constructed on coastal uplands rather than wetlands.

CONCLUSION: This alternative is expected to result in temporary (one growing season approximately 6 months) dieback of up to 100 ha of wetlands that have been contacted by spilled oil. Some of these wetland areas could be converted to open water habitat where higher concentrations of oil accumulated resulting in plant death and eventual land loss. The probability of one or more spills (greater than or equal to 10,000 bbl) occurring Gulfwide ranges from 10 to 22 percent. Up to 30 ha of wetlands could be eroded along navigation channels as a result of OCS-vessel traffic within the channels. Most wetland impacts will occur in Louisiana and along the north Texas coast.

(b) Barrier Beaches

Although some contact to barrier beaches from accidental spillage of oil will occur along the Louisiana and Texas coasts, the oil will be cleaned from the beach with no permanent affects on the configuration of the barrier feature. Construction activities associated with the proposed action, including pipeline landfalls, infrastructure construction, and maintenance dredging and deepening of navigation channels, are expected to have minimal impacts. Using proper construction techniques, pipeline landfalls can be done with no observable effects on barrier beaches. New construction projects will not likely be located on barrier beaches or islands. Maintenance dredging and channel deepening may have some erosional effects on beaches downdrift from the navigation channel, but these impacts will be localized.

CONCLUSION: This alternative is not expected to result in permanent alterations of barrier beach configurations, except in localized areas near navigation channels that have been dredged and deepened.

(2) Alaska Region

WETLANDS AND ESTUARIES: Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Impacts on wetlands and estuaries would be the same as Alternative I. Section IV.D.1.a(8) describes the impacts on wetlands and estuaries.

CONCLUSION: Under Alternative IV, the primary effects on wetland-estuarine habitats in the Alaska Region are expected to come from a causeway and pipeline-landfall construction and oil spills. Hydrological effects from the causeway (changes in the physical integrity of perhaps 5% of the habitat) and some effects (perhaps 5-10%) on the distribution of species (anadromous fish) are expected to last for more than 10 years. Turbidity effects from pipeline burial on wetland-estuarine habitats are expected to be short term, lasting less than 2 years. Oil-spill contamination of wetland-estuarine habitats is expected to have adverse effects on the biological diversity and productivity of invertebrate communities lasting for more than 10 years.

(3) Pacific Region

WETLANDS AND ESTUARIES: Due to the small number of estuaries in the Southern California Planning Area, and limited entrance openings of existing estuaries, it is unlikely a spill would enter an estuary. Further, dilution, weathering, and containment would reduce the chance of disturbance particularly smaller estuaries and fish spawning streams from spills of 1,000 bbl or more. Oil spill impacts will be the same as for Alternative I, although, because the volume of the additional tanker spill increases the total volume of oil spilled, the assumption that a spill will enter an estuary has more validity. Impacts, as described in Alternative I (Section IV.D.1.a(8)), should a spill enter an estuary and remain for several tidal cycles, impacts could involve destruction of a major part of the community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery would require at least 5 years. If a smaller portion of the estuary is covered by oil and does not penetrate into the sediments, such as might occur if the oil remains for no more than a couple of tidal cycles, impacts would likely be less severe. Mortality of a noticeable segment of the benthic community could occur along with, alteration of some ecological relationships, but recovery could occur within 2 years.

CONCLUSION: Impacts of an assumed tanker spill entering an estuary and remaining for several tidal cycles are expected to cause destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require at least 5 years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no measurable interference with ecological relationships in the Southern California Planning Area.

i. Impacts on Seafloor Habitats

(1) Gulf of Mexico Region

(a) Chemosynthetic Communities

The only impact-producing factor threatening the chemosynthetic communities is physical disturbance of the bottom, which would destroy the organisms comprising these communities. Such disturbance would come from those OCS-related activities associated with pipelaying, anchoring, structure emplacement, and seafloor blowouts. Only structure emplacement is considered to be a threat, and then only to the high-density (Bush Hill-type) communities. The widely distributed low-density communities would not be at risk. The provisions of NTL 88-11 (currently in effect), requires surveys prior to drilling and avoidance. This will greatly reduce, but not completely eliminate, the risk.

CONCLUSION: The activities associated with the proposed action are expected to cause little damage to the physical integrity, species diversity, or biological productivity of either the wide-spread low-density chemosynthetic communities or the rarer, widely scattered high-density Bush Hill-type chemosynthetic communities. Recovery from any damage is expected to take less than two years.

(b) Topographic Features

Impact-producing factors resulting from routine activities of oil and gas exploration and development include anchoring, structure emplacement and removal, and operational discharges (muds and cuttings, produced water). These activities may threaten the communities of the topographic features. Because protections similar to that of the topographic features stipulation are assumed to be attached to leases issued as a result of this proposal, operational discharges (drilling muds and cuttings, produced waters) will have no impact on the biota of the banks.

Impact-producing factors resulting from accidents during such oil and gas activities include blowouts and oil spills. These activities may threaten the communities of the topographic features. Because protections similar to that of the topographic features stipulation are assumed to be attached to leases issued as a result of this proposal, such activities cannot occur within the no activity zones, which include all the sensitive reefal habitats. Thus there will be no mechanical damage to reefs resulting from blowouts. Suspended sediments from a blowout may reach the biota of the bank, but in very small amounts that will be swept clear of the bank in a matter of a few hours. Impacts would be sub-lethal at worst, and recovery would take place within 1-3 days. Oil spills could cause damage to benthic organisms if the oil contacts the organisms and remains in contact for an extended period of time. Oil from surface spills will not contact the reefs, and contact from oil is likely only from spills from blowouts, which are rare in the Gulf. As with resuspended sediments, such oil would reach a bank only in very small amounts that will be swept clear of the bank in a matter of a few hours. Impacts would be sub-lethal at worst, and recovery would take place within 1-3 days.

CONCLUSION: Based on the scenario for this alternative, including the protections similar to those of the topographic features stipulation, the activities associated with Alternative I are expected to cause little to no damage to the physical integrity, species diversity, or biological productivity of the habitats of the topographic features of the Gulf of Mexico. Small areas of 5-10 m^2 would be impacted, and recovery from this damage to pre-impact conditions is expected to take less than 2 years, probably on the order of 2-4 weeks.

(c) Live Bottoms

The impact-producing factors resulting from routine activities of oil and gas operations include mechanical damage caused by underwater oil spills, blowouts, anchoring, structure emplacement and removal, drilling discharges, and pipeline emplacement. These activities may threaten the sessile and pelagic communities associated with the crest and flanks of the hard bottom and low-relief hard-bottom features of the region. Because protection similar to that of the biological stipulations are assumed to be attached to leases issued as a result of this proposal, the effects from these factors will have been mitigated on the biota of the hard bottoms. The potential impacts from spilled oil include uptake of hydrocarbons and reduced visibility; these impacts may be serious or fatal to the local biota. A blowout within a 100 m of a hard bottom community could result in the smothering of the biota within a very limited area of a hard bottom due to sedimentation. The placement of drilling rigs, platforms, and anchors on the seafloor will crush the organisms directly beneath the legs or mat used to support the structure. Structure placement and anchor damage from support boats and ships, floating drilling units, and pipeline-laying vessels disturbs areas of the seafloor and is the most serious threat to live-bottom areas at these depths. Structure removal using explosives (the most common removal method) could suspend sediments throughout the water column to the surface and may cause substantial impacts to nearby habitats. Deposition of these sediments would occur largely within the first 100 m of the site. Explosive structure removals create shock waves, which could also harm resident biota in the immediate vicinity. Smothering of organisms through deposition of drilling discharges (drill muds and cuttings) may occur; less obvious sublethal effects may also take place. Pipeline emplacement directly affects the benthic communities through burial and disruption of the benthos, and through resuspension of sediments. These resuspended sediments may clog filter-feeding mechanisms and gills of fishes and sedentary invertebrates. The majority of these impacts are mitigated through implementation of the biological stipulations or comparable measures. Because protection similar to that of the biological stipulations will be attached to leases issued as a result of this proposal, the effects from these factors will have been mitigated on the biota of the region. This proposed alternative would slightly change some of the OCS-related activities which were detailed for the proposed action. A reduction in the number of exploration and delineation wells would be evident due to the slowed leasing pace in the region of the central and eastern gulf. Likewise, a similar reduction in the number of development and production wells, number of platform installations and removals, miles of pipelines installed, and potential oil spills would be seen. However, the live-bottom stipulation effectively mitigates the effects of OCS-activities on hard-bottom communities.

CONCLUSION: The impact of this alternative on the hard bottom trend region is expected to be such that any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 2-4 months.

(2) Alaska Region

STEFANSSON SOUND BOULDER PATCH: Alternative IV is expected to have the same level of effect on the Boulder Patch benthic communities as the Proposal, Alternative I, because a pipeline oil spill and pipeline burial and causeway construction are assumed to occur in Stefansson Sound near the Boulder Patch, as assumed under the Alternative I.

CONCLUSION: The effect of Alternative IV on the Boulder Patch communities is expected to be the same as under Alternative I. Oil-spill effects on the productivity and diversity (perhaps 10%) of the Boulder Patch benthic organisms are expected to persist for 2 years. Turbidity and sedimentation effects on the growth and productivity of benthic organisms (perhaps 1-2%) of the Boulder Patch from pipeline burial and causeway construction are expected to persist for about 2 years.

(3) Pacific Region

(a) Intertidal Benthos

A generic discussion of the possible impacts of accidental oil spills on intertidal communities is presented in Section IV.A. Oil spill impacts for Alternative IV will be the same as for Alternative I, although, because the volume of the additional tanker spill increases the total volume of oil spilled, the chance of causing impacts from oil spills is increased. Thus, as discussed in Section IV.D.1.a(9), it is assumed that a tanker spill will contact major isolated rocky intertidal areas of Point Dume, Palos Verdes, or Newport to Dana Point and cause noticeable mortality and alteration of ecological relationships within the rocky intertidal community. Recovery could be retarded in some species for a year and different assemblages within the community could require at least 6 years to return to pre-spill conditions. Similar impacts would occur if such a spill contacted the more biologically sensitive rocky intertidal habitats in the Point Conception - Point Buchon area and the Channel Islands. Noticeable mortality of much of the community would occur with recovery requiring, possibly up to 10 years.

The impacts of a spill greater than or equal to a 1,000 bbl on sandy beach intertidal communities would include smothering and immobilization of species. Recovery of the sandy beach biota is expected to occur in less than one year since most of the sandy beach communities contain fast-growing and highly mobile organisms that have adapted to the constant physically disturbed environment of shifting sands (ADL 1985; Chambers Group, Inc. 1986). Such impacts would be limited to local sandy beach habitats with little to essentially no impacts considering the region as a whole due to rapid recovery and to the low number of organisms affected.

CONCLUSION: Adoption of Alternative IV is expected to result in smothering and immobilization to portions of local sandy beach populations of several species limited to the area contacted by the spill with recovery occurring within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community limited to the area contacted by the spill. Recovery could be retarded in some species for a year and different assemblages within the community could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis.

(b) Subtidal Benthos

Assumptions regarding oil spills from Alaskan OCS and foreign tankers has been discussed previously. Impacts on subtidal benthic communities are of greatest concern on shallow, near-shore and hard bottoms where oil has a greater chance of contact or mortalities may contribute to a greater interference with ecological relationships or require longer to recover than other bottom communities. Oil spill impacts will be the same as for Alternative I, although, because the volume of the additional tanker spill increases the total volume of oil spilled, the chance of causing impacts from oil spills is increased. Thus, as described in Section IV.D.1.a(9), assuming hard bottoms or shallow near-shore areas are contacted an assumed tanker spill, noticeable mortality, involving thousands of individuals, of the community contacted could cause alterations of ecological relationships lasting for at least two years. Recovery would be slower and impacts higher if a species that has an important community function is destroyed on a particular rocky bottom substrate. The community may be altered until the population of the impacted species is replaced by brood stock from other areas.

CONCLUSION: Adoption of Alternative IV is expected result in the loss or functional disruption of a few subtidal benthic assemblages or communities at local areas within the region. An oil spill of 1,000 bbl or more contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of the hard bottom community contacted causing alterations of ecological relationships lasting for at least two years. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tankers along the west coast over the 35-year life of proposal.

j. Impacts on Coastal Communities

(1) Gulf of Mexico Region

(a) Demography and Employment

Selection of the proposed alternative would not reduce the level of exploration, development, and production activity, nor the associated employment, expected to result from the proposed action, Gulfwide. A total of approximately 355,400 person-years of employment (direct, indirect, and induced) are required during the 45-year life of the proposed program. The States of Louisiana, Mississippi, and Alabama are expected to collectively provide almost 78 percent of the total employment required in support of the proposal. Texas contributes over 18 percent of the Gulf Region employment impact. The least impacted state in the Gulf of Mexico Region is Florida, accounting for only four percent of the employment impact projected for the socioeconomic impact area as a result of the proposal. Employment projected to result from oil spill clean-up activities due to the proposed alternative are approximately equivalent to 580 person-years of employment. It is expected that employment demands in support of the proposal will be met with the existing population and available labor force.

CONCLUSION: Alternative IV is expected to result in a total of 355,400 person-years of employment (direct, indirect, and induced) during its 45-year life. Peak levels of employment are expected to occur in the year 2000, with a total of approximately 16,600 workers involved in primary, secondary, and tertiary industries. Exploratory activities which occur during the first 17 years of the life of the proposed alternative, are the main contributor to peak year employment. The greatest impact is expected in the coastal communities of Louisiana. However, it is expected that employment demands in support of the proposal will be met with the existing population and available labor force.

(b) Public Services and Community Infrastructure

Selection of the alternative would not reduce the level of exploration, development, and production activity, nor the associated employment, expected to result from the proposed action. Impacts to public services and infrastructure would be related to dramatic, short-term population increases or decreases, which are not projected as a result of the alternative. No positive net migration into the coastal subareas of the northcentral and northwestern Gulf of Mexico is expected to occur as a result of the alternative. It is expected that employment needs will be met by those currently employed in the oil and gas industry, as well as the unemployed and underemployed, and new employees already living in the area. In addition, jobs created by the proposal would likely reduce the amount of migration out of the coastal subareas of the northcentral Gulf when compared to scenarios without the proposal. It is expected that employees leaving public service and infrastructure-related jobs could be replaced by the existing labor pool. Exclusion of the northeastern Gulf of Mexico from OCS oil and gas leasing would not be expected to impact public services and community infrastructure of the area given the levels of services and infrastructure found in the northeastern Gulf and the limited amount of employment expected under the proposed action.

CONCLUSION: Under this alternative, minimal impacts are expected to occur to public services and community infrastructure.

(c) Social Patterns

Selection of the alternative would not reduce the level of exploration, development, and production activity, nor the associated employment, expected to result from the proposed action. Impacts to social patterns would be related to the dramatic changes in population and the disruption of environmental resources, as well as conditions inherent to OCS-related employment (i.e., work scheduling and rate of pay). No positive net migration into northcentral and northwestern Gulf coastal areas is expected to occur from those currently employed in the oil and gas industry, as well as the unemployed and underemployed, and new employees already living in the area. It is expected that jobs created by the alternative would likely reduce the amount of out-migration when compared to scenarios without the proposal and that minor displacement from traditional occupations will occur as a result of the alternative. This displacement will be mitigated, to some extent, by the extended work schedule associated with OCS-related employment. The work schedule is expected to have some deleterious effects on family life in some individual cases. Impacts caused by the displacement of traditional occupations and relative wages are expected to occur to a minimal extent. Exclusion of the northeastern Gulf of Mexico from OCS oil and gas leasing would likely alleviate fears of some individual and groups in the area concerning potential environmental effects of OCS oil and gas activity offshore Florida.

CONCLUSION: Under this alternative, deleterious impacts to family life are expected to occur in some individual cases, as are minimal impacts to traditional occupations. Potential psycho-social impacts in the northeastern Gulf would likely be alleviated.

(2) Alaska Region

(a) Demography and Employment

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Impacts on demography and employment would be the same as Alternative I. Section IV.D.1.a(10) describes the impacts on demography and employment.

CONCLUSION: For the regional centers for other than Cook Inlet , local employment generated by Alternative IV OCS activity is expected to be more than 5 percent but not more than 10 percent of projected employment for 2 to 5 years, and no one sector of the local labor force would change by more than 10 percent. For Cook Inlet, local employment generated is expected to account for 1 to 5 percent for less than 2 years; and no sector of the local labor force changes more than 10 percent. Population increases would be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole would be between 1 and 5 percent for less than years with no change in any sector of the state labor force greater than 10 percent.

For each of the six OCS sale areas, an oil spill would generate up to 15 jobs in the closest regional center for up to 1 month.

(b) Land Use

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Impacts on land use would be the same as Alternative I. Section IV.D.1.a(10) describes the potential impacts on land use .

CONCLUSION: Alternative IV is expected to alter or disrupt land use patterns in less than one-half of 1 percent of Alaska's lands. However, the proposal could permanently (in excess of 20 years) alter regional land use patterns directly and indirectly impacted by pipeline and pipeline-service-road construction could be altered for over 20 years.

(c) Transportation Networks

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Impacts on transportation networks would be the same as Alternative I. Section IV.D.1.a(10) describes the potential impacts on transportation networks.

CONCLUSION: Based on the scenario for Alternative IV, vessel and air traffic in Alaska are not expected to increase to the point at which the transportation systems are stressed.

(d) Sociocultural Systems

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Impacts on sociocultural systems would be the same as Alternative I. Section IV.D.1.a(10) describes the potential impacts on sociocultural systems.

CONCLUSION: Based on the scenario assumptions, Alternative IV is expected to contribute to the increasing urbanization of the North Slope Borough, and Barrow in particular, and increase the need for wage income. Dysfunctional social effects, such as domestic violence and substance abuse, are expected to be sustained and perhaps increased. Adverse effects on subsistence, especially from oil spills, are expected to adversely affect sociocultural systems. Effects on sociocultural systems are expected to be most unsettling in areas that are least urbanized.

(3) Pacific Region

(a) Demography and Employment

Adoption of Alternative IV would eliminate all impacts in the Pacific Region, both positive and negative, associated with the proposed action. However, operations will continue on existing leases, TAPS oil will continue to be tankered to west coast and Gulf of Mexico ports, and additional oil will be imported from foreign sources. Employment increases will continue from regional expansion in most economic sectors including oil and gas activities from existing leases in State and Federal waters, residential and commercial construction, and expansion of marine transportation activities. Population will continue to increase from general growth and immigration.

If an oil spill occurs and contacts the coast, it would involve some employment opportunities in cleanup operations. For every mile of coastline oiled, it is estimated that approximately 100 temporary workers would be employed for a period of about 30 days in the cleanup operations. Employment from oil spill cleanup activities due to this alternative is approximately equivalent to 400 person-years of employment. But it is expected that employment would be temporary and would not involve any population increase.

Employment and population associated with ongoing growth are estimated to increase about 2 percent per year in the southern California area.

CONCLUSION: Adoption of Alternative IV is expected to eliminate the employment and population increases associated with the proposed action.

(b) Land Use

Adoption of Alternative IV would eliminate all impacts to land use associated with the proposed action. However, operations will continue on existing leases, TAPS oil will continue to be tankered to west coast and Gulf of Mexico ports, and additional oil will be imported from foreign sources. Impacts to land use may continue to occur from housing demands related to the general population increase and from industrial and commercial demand related to general economic growth.

No changes to land use were expected to result directly from oil and gas activities under Alternative I since no new onshore facilities were expected to be constructed. Selection of Alternative IV would eliminate land use impacts associated with housing needs resulting from the proposal. This includes the potential conversion of about 230 acres of open space land for residential use.

CONCLUSION: Adoption of Alternative IV is expected to eliminate the land use impacts associated with the proposed action.

(c) Vessel Traffic

Adoption of Alternative IV would eliminate all impacts to vessel traffic associated with the proposed action. However, operations will continue on existing leases, TAPS oil will continue to be tankered to west coast and Gulf of Mexico ports, and additional oil will be imported from foreign sources.

Should one or more oil spills occur, there is the potential for impacts to large marine vessels and local commercial fishing vessels. Ship traffic may be rerouted around the spill for the duration of at-sea-cleanup activities (which could last from 30 to 60 days).

CONCLUSION: Adoption of Alternative IV is expected to eliminate the impacts on vessel traffic associated with the proposal. Impacts due to tanker spills would result in ship traffic rerouting around the spill for the duration of at-sea cleanup activities (which could be as long as 2months). Rerouting would be an inconvenience to shipping transiting the area, and would result in some expenses due to additional travel time, fuel, and labor costs. In addition, there would be costs associated to damage to fishing and recreational boats, if oil contacted any vessels in the area.

(d) Public Services

Adoption of Alternative IV would eliminate all impacts on water supply associated with the proposed action. However, operations will continue on existing leases, TAPS oil will continue to be tankered to west coast and Gulf of Mexico ports, and additional oil will be imported from foreign sources.

The activities associated with Alternative I scenario were expected to result in water demand of about 10 million gallons of potable water in the peak year 2007 and about 47 million gallons of non-potable water. The expected impacts on water supply from Alternative I would not occur if Alternative IV were selected.

CONCLUSION: Adoption of Alternative IV is expected to eliminate the demand for water associated with the proposal.

k. Impacts on Fisheries

(1) Gulf of Mexico Region

(a) Commercial Fishing

A number of routine events such as production platform emplacement may adversely affect commercial fishing. It is estimated that new offshore platforms resulting from the proposal will remove approximately 960 ha (2,400 ac) of trawling space from commercial fishing, representing less than 0.01 percent economic loss to the commercial fishing of shrimp and sciaenid groundfish for no more than one fishing season.

Accidental events such as underwater OCS obstructions and oil spills may adversely affect fish resources. It is assumed that 3,636 km (2,258 m) of offshore pipeline will result from the proposed action. Underwater obstructions will cause a 0.01 percent or less economic loss to the commercial fishing of menhaden, shrimp, and sciaenids for no more than one fishing season. It is assumed that one spill (1,000 bbl or more) will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. This spill will contact and affect 16 ha of estuaries. The small oil spills will contact and affect no more than 100 ha of estuaries and fish nurseries for less than one fishing season. Both lethal and sublethal effects on commercial fisheries resources and depression of commercial fishing activities will occur.

CONCLUSION: As a result of this alternative, a 0.01-0.1 percent economic loss to commercial fisheries of estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters is expected to occur for one to two fishing seasons. The principal cause of impacts is spilled oil, and the probability ranges from 10 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Recreational Fishing

The proposed program will lead to the installation of new offshore gas and oil production platforms offshore Texas, Louisiana, Mississippi, and Alabama which will function as very large artificial reefs attracting sport fish and fishermen. Oil spills will temporarily discourage offshore fishing and lead to a loss of fishing activity and a decline in the sale of fishing equipment, supplies and services within the coastal community impacted. The lack of fishing activity and the loss of sales of fishing equipment, supplies and services caused by oil pollution will not extend beyond the community impacted or the days or weeks it takes to clean up the spill.

CONCLUSION: The marine recreational fishing industry is expected to continue its growth and expansion in the Gulf of Mexico in direct association with continued and economic growth in general, and expanded gas and oil leasing, in particular. Many of the future offshore fishing trips in the northern Gulf will extend the focus of specific fishing efforts in direct proximity to the new gas and oil platforms expected to result from the proposal in the northwestern and northcentral Gulf. Spills will disrupt fishing activities in the offshore areas directly impacted, and can lead to a decline in the sale of fishing equipment, supplies, and services for up to one fishing season when large quantities of oil pollution come ashore in a coastal fishing community.

(2) Alaska Region

COMMERCIAL FISHING: Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Commercial fishing impacts would be the same as Alternative I. Section IV.D.1.a(11) describes the potential impacts on commercial fishing industry.

CONCLUSION: The expected impact of Alternative IV on commercial fishing in the Bering Sea and Gulf of Alaska is loss of catch and direct employment and up to 5 percent damage or loss of fishing gear and up to 5 percent loss of secondary employment. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor and no more than 10 percent for space onshore. These impacts are expected to last for as many seasons as there is OCS activity.

As a result of assumed oil spills, commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days, the commercial fisheries would have up to 5 percent loss of catch and up to 5 percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil could be 5 percent.

(3) Pacific Region

(a) Commercial Fishing

Under Alternative IV, assumed tanker spills in the Pacific Region could cause commercial fishermen (including kelp harvesters and mariculture operators) to sustain economic losses due to a reduction in total catch, tainting of marine organisms, fouling of gear and vessels, and possibly port closures. Locally, more than half of the combined landed value to ports within the Santa Barbara sub-region is composed of sea urchin, abalone, lobster and crab harvested by fixed gear fishermen and commercial divers. Contact of a spill of important fishing areas could cause tainting of fisheries resources or contaminate fishing gear, causing fishermen to sustain economic losses for about one month or as long as it takes to clean their gear. A spill of over 1,000 bbl could prevent fishermen from leaving port by oil containment booms. This could cause fishermen to sustain complete economic losses during the period that the booms are in place (about one month). The consequences of an oil spill to the regional fishing industry would be most severe if oil contacted Los Angeles and Long Beach Harbors and port closure resulted.

Oil spill impacts in the Alternative IV scenario are expected to be the same as for Alternative I, although, because the volume of the additional tanker spill increases the total volume of oil spilled, the chance of causing impacts from oil spills is increased slightly. As described in Alternative I (Section IV.D.1.a(11)), reductions of catches as a result of the tanker spill, could cause the Santa Barbara subregion to experience a number of impacts, including high economic losses for two seasons ranging from 20 to 30 percent, and more than 10 percent unemployment among fixed-gear fishermen. Closure of the Los Angeles and Long Beach Harbors by the spill could have repercussions on local, regional and statewide levels, since this harbor receives the bulk of commercial fish landings for southern California, a reduction in activity .

CONCLUSION: Adoption of Alternative IV is expected to result in economic losses to the commercial fishing industry ranging from 20 to 30 percent lasting for two seasons and more than 10 percent unemployment of the fixed-gear fishermen and financial losses of 10 to 20 percent of economically dependent businesses.

(b) Recreational Fishing

Oil spill impacts in the Alternative IV scenario are expected to be the same as for Alternative I, although, because the volume of the additional tanker spill increases the total volume of oil spilled, the chance of causing impacts from oil spills is increased.

As with Alternative I (Section IV.D.1.a(11)), it is assumed that the oil spill in the Southern California Planning Area will contact a harbor where sport boat operations concentrate, operators of commercial passenger fishing vessels and skiff rental facilities may sustain local temporary (about one month) economic losses (10-20 percent). An important characteristic of party and private boat fishing which can decrease otherwise more serious impacts is their mobility which will facilitate avoidance of affected areas and lessen the impacts from possible reductions in available catch, possible capture of tainted fish, and contamination of gear. Regionally, economic costs to the sportfishing industry of an oil spill are expected to be minimal due to the large area involved and the number of harbors that are likely to be unaffected by a spill.

CONCLUSION: Adoption of Alternative IV is expected to result in oil spill contact with a harbor used by sport fishermen resulting in local economic losses of 10 to 20 percent over a period of approximately a month, or the length of time needed for spilled oil to be cleaned up or dissipated by wind and waves. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced by the proposal, fisheries resources available to sportfishermen will be unchanged.

l. Impacts on Subsistence

(1) Alaska Region

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Subsistence impacts would be the same as Alternative I. Section IV.D.1.a(12) describes the potential impacts on subsistence.

CONCLUSION: Impacts of Alternative IV on subsistence are expected to be centered predominantly on the arctic communities of the NSB as a result of the four proposed Chukchi and Beaufort Seas sales. One or more important subsistence resources are expected to become unavailable, undesirable for use, or available only in greatly reduced numbers for one or more periods of 1 to 2 years during the life of the proposed leases in the Arctic. Effects on subsistence in the Gulf of Alaska include reducing the availability or accessibility of at least one important subsistence resource for a period not exceeding 1 year. Similar effects would be expected on Kodiak Island and on the Alaska Peninsula. The subsistence of Bristol Bay and Alaska Peninsula residents would be affected for at least 1 year. There is a 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the proposal in the Alaska Region.

(2) Pacific Region

Impacts to subsistence resources in the Pacific Region from accidental oil spills under Alternative IV are similar to those identified for Alternative I (Section IV.D.1.a(12)). Impacts to subsistence resources from accidental tanker spills would depend upon the location and season. The greatest effects to subsistence could be expected if a spill of 1,000 bbl or more contacted rocky intertidal areas near population centers. This could have the effect of reducing the availability or desirability of one or more important species in some local areas on the coast for up to a year.

CONCLUSION: Adoption of Alternative IV is expected to result in temporary effects on subsistence in the Pacific Region due to oil spills. Assuming occurrence and contact, an oil spill that contacts an intertidal subsistence area is expected to result in a reduction in the availability or desirability of one or more subsistence resources for up to a year. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

m. Impacts on Archaeological Resources

(1) Gulf of Mexico Region

HISTORIC: The greatest potential impact to an historic archaeological resource as a result of the proposed action would result from a contact between an OCS offshore activity (platform installation, drilling rig emplacement, dredging, and pipeline projects) and an historic shipwreck.

Most other activities associated with this alternative are expected to have little to no impacts on historic archaeological resources. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. Historic cultural resources, therefore, will not be affected by these activities. The chance of contact from an oil spill associated with this alternative on a historic site is very small. Furthermore, the impact from an oil-spill contact on an historic coastal site, such as a fort or lighthouse, would be visual due to oil contamination. These impacts would be temporary (lasting up to weeks) and reversible.

An OCS activity could contact a shipwreck because of incomplete knowledge on the location of shipwrecks in the Gulf. Such an event could result in the disturbance or destruction of unique or significant historic archaeological information. However, it is estimated that magnetometer surveys at 50 m linespacing will be 90 percent effective at locating historic shipwrecks within high probability areas. Other factors associated with this alternative are not expected to affect historic archaeological resources.

PREHISTORIC: Impact-producing factors may threaten the prehistoric archaeological resources of the northwestern Gulf. An impact could result from a contact between an OCS activity (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) and a prehistoric site located on the continental shelf. The archaeological surveys and archaeological clearance of sites that are required prior to an operator beginning oil and gas activities in a lease block are estimated to be 90 percent effective at identifying possible prehistoric sites. Since the survey and clearance provide a significant reduction in the potential for a damaging interaction between an impact-producing factor and a prehistoric site, there is little chance for damaging interaction between an impact producing factor and an archaeological site or resource.

Onshore development as a result of this alternative could result in the direct physical contact between new facility construction, and pipeline trenching. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. There is little to no expected impact from these factors.

Should an oil spill contact a coastal prehistoric site, the potential for dating the site using radiocarbon methods could be destroyed. Oil spill cleanup operations could physically impact coastal prehistoric sites. Previously unrecorded sites could also experience an impact from oil-spill cleanup operations. Should such contact occur unique or significant archaeological information could be lost.

CONCLUSION: As a result of this alternative, it is expected that a historic or prehistoric archaeological site containing significant but not unique information would be disturbed to an extent that the site loses at least one but not all the physical features which would yield scientific information.

(2) Alaska Region

Routine activities and accidental events are assumed to occur at the same levels for Alternative IV as for Alternative I in the Alaska Region. Archaeological impacts would be the same as Alternative I. Section IV.D.1.a(13) describes the potential impacts on archaeology.

CONCLUSION: Based on the scenario assumptions for Alternative IV, impacts on Alaska Region archaeological resources, it is expected that some impact may occur to coastal historic and prehistoric archaeological resources from accidental oil spills. Although it is not possible to predict the precise number or types of sites that would be affected, it is expected that a small amount of significant archaeological information will be lost.

(3) Pacific Region

Adoption of Alternative IV excludes OCS leasing activities in the Southern California Planning Area. By excluding leasing activities, routine exploratory and developmental operations described in Alternative I, such as drilling, platform installation, or installation of offshore pipelines will not occur in the planning area. Therefore, no impacts to archaeological resources for routine activities are anticipated to occur.

No new onshore facilities or new pipeline landfalls will occur in southern California as a result of Alternative IV. Consequently, no impacts to archaeological resources are expected.

One tanker spill of imported oil is estimated to occur in southern California for this alternative. Impacts to archaeological resources from accidental spills of imported oil or Alaska oil transported by tankers include temporary degradation of the viewshed of contacted historic or prehistoric sites, and damage to potential archaeological sites during clean up operations. Degradation of a historic viewshed could negatively affect a site's National Register eligibility. The duration this impact depends on the size of the spill, the oil retention of the particular stretch of coastline, and the amount of clean up effort. It is anticipated that spill cleanup operations will take a few weeks to one month. Once the cleanup is completed, the viewshed is expected to return to its pre-spill state.

Archaeological sites can be damaged or destroyed during cleanup operations as the crisis atmosphere of the cleanup would likely preclude a survey to identify and protect sites in the area. The level of damage would depend on the value of information lost at each affected site and the number of sites impacted.

Submerged sites are not expected to be impacted by an oil spill unless the oil sinks and settles on the bottom, coating any artifacts that may be present. The impact to any submerged sites contacted by oil will depend upon the amount of contamination, and how the artifact responds to the coating of oil. If artifacts absorb oil it could affect radiocarbon dating of the site. Overall, oil spills are expected to result in a negligible loss of scientific information from archaeological resources.

CONCLUSION: Assuming for Alternative IV that an accidental tanker spill occurs and contacts the shoreline, the viewshed of onshore prehistoric or historical sites would be temporarily degraded during the spill and associated cleanup activities.

n. Impacts on Recreation and Tourism

(1) Gulf of Mexico Region

Routine drilling and production in nearshore tracts within 10 miles of coastal park and recreation areas off the coast of Louisiana, Mississippi and Alabama will be visible from shore during fair weather conditions. Helicopters and boat traffic servicing offshore operations may also be seen and heard by recreational beach users and tourists. Pipeline construction across recreational beaches in Texas, Louisiana, and Mississippi or Alabama will remove 1,200-1,600 ft of beach shorefront from recreational use for 2-3 weeks while each landfall is under construction. Offshore platforms, especially those within 25 miles of shore will attract fish and fishermen. Accidents associated with drilling, production and transportation of gas and oil will cause pollution and debris on coastal beaches. Oil spills are expected to lead to closure of beach and park areas along the coasts of Louisiana and Texas for up to six weeks.

CONCLUSION: This alternative is expected to result in closure (less than a full season or 6 months) at a few park and recreation areas during one of the 45 years of the project life as a result of major oil spills. Tourist losses associated with these closures will be local and represent less than 10 percent of projected economic gains. Platforms installed offshore as a result of the proposal, especially those within 25 miles of shore, will attract recreational fishermen and divers.

(2) Pacific Region

The impacts to recreation resources and tourism as a consequence of adoption of Alternative IV are essentially the same as those identified for Alternative I (Section IV.D.1.a(14)). The differences between the two cases lie in the source of impacts. Adoption of Alternative IV means that no new oil and gas operations will occur in southern California as a result of the proposed program. However, TAPS oil will continue to be tankered to west coast and Gulf of Mexico ports, and additional oil will be imported from foreign sources.Impacts to recreational resources from an accidental tanker spills greater than 1,000 bbl include closure of the affected beach for approximately one month, temporary displacement of resource users to unaffected sites, financial losses to local merchants servicing the contaminated area, and temporary degradation of aesthetic qualities of the spill site. These impacts are expected to continue for the duration of clean up operations, approximately one month.

CONCLUSION: Under Alternative IV, an accidental tanker spill is expected to close recreation facilities at the affected site for one month. Recreation resource users will be temporarily displaced and local merchants deriving income from those users will experience an economic loss during the clean up period. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the proposal.

5. Alternative V — Establish Coastal Buffers

Alternative V establishes coastal buffers in the Gulf of Mexico, Alaska, Pacific and Atlantic Regions by excluding blocks considered for lease that lie within the areas listed below.

Alternative V — Establish Coastal Buffers

Coastal Buffer (Part A) — Eastern Gulf of Mexico Planning Area

Part A-1 of Alternative V establishes a coastal buffer within 30 miles of the west coast of Florida in the Eastern Gulf of Mexico Planning Area (see Figure II.E.1-1).

Coastal Buffer (Part B) — Gulf of Alaska Planning Area

Part B of Alternative V establishes a coastal buffer offshore Yakutat in the Gulf of Alaska Planning Area (see Figure II.E.1-2).

Coastal Buffer (Part C-1) — Beaufort Sea And Chukchi Sea Planning Areas

Part C-1 of Alternative V establishes a coastal buffer along the Stamukhi zone from the Pt. Barrow area in the Beaufort Sea Planning Area to the Pt. Hope area in the Chukchi Sea Planning Area (see Figure II.E.1-3).

or

Coastal Buffer (Part C-2) — Beaufort Sea And Chukchi Sea Planning Areas

Part C-2 of Alternative V establishes a coastal buffer in the Chukchi Sea located offshore the Barrow area in the Beaufort Sea Planning Area and offshore the Pt. Hope area in the Chukchi Sea Planning Area (see Figure II.E.1-4).

Coastal Buffer (Part D) — St. George Basin Planning Area

Part D of Alternative V excludes 123 blocks under consideration for future leasing that lie within 30 miles of the coast of the Pribilof Islands (see Figure II.E.1-5).

Coastal Buffer (Part E) — Norton Basin Planning Area

Part E of Alternative V excludes 9 blocks under consideration for future leasing that lie within 12 miles of the coast of the Yukon Delta (see Figure II.E.1-6).

Coastal Buffer (Part F) — Hope Basin Planning Area

Part F of Alternative V excludes 42 blocks under consideration for future leasing that are located in Hope Basin along the Stamukhi zone (see Figure II.E.1-7).

Coastal Buffer (Part G) — Mid-and South Atlantic Planning Areas

Part D of Alternative V excludes 150 blocks under consideration for future leasing that lie within 50 miles of the coast of the Mid- and South Atlantic Planning Areas (see Figure II.E.1-8).

Coastal Buffer (Part H) — Southern California Planning Area

Part H of Alternative V excludes 24 blocks under consideration for future leasing that lie within 12 miles of shore from the Morro Bay area south to the Santa Maria River mouth in the Southern California Planning Area (see Figure II.E.1-9).

RESOURCE ESTIMATES: Resource estimates for Alternative V, are presented in Table IV.D.5-1. Section IV.D.1.a provides a discussion on the PRESTO model used to calculate the resource estimates that are assumed to be leased, discovered and produced.

Table IV.D.5-1. Conditional Resource Estimates — Establish Coastal Buffers

REGION AND PLANNING AREA	OIL (BBO)	GAS (TCF)	MPHC
GULF OF MEXICO REGION			
Western Gulf of Mexico	0.23	3.51	1.00
Central Gulf of Mexico	0.57	5.64	1.00
Eastern Gulf of Mexico (Part A)	0.02	0.10	0.98
ALASKA REGION			
Beaufort Sea (Part C-1)	0.52	—	0.16
Beaufort Sea (Part C-2)	0.52	—	0.16
Chukchi Sea (Part C-1)	1.88	—	0.21
Chukchi Sea (Part C-2)	2.01	—	0.21
Hope Basin (Part F) *or*	0.24	—	<0.01
St. George Basin (Part D)	0.23	—	0.02
Norton Basin (Part E) *or*	0.30	—	<0.01
St. Matthew-Hall *or*	<0.01	—	<0.01
Navarin Basin	0.24	—	0.03
Cook Inlet	0.16	—	<0.01
Gulf of Alaska (Part B)	0.34	—	0.04
PACIFIC REGION			
Southern California (Part H)	0.26	0.91	1.00
ATLANTIC REGION			
Mid- and South Atlantic (Part G)	0.07	2.02	0.63

BBO - Billion Barrels of Oil
TCF - Trillion Cubic Feet
MPHC - Marginal Probability of Commercial Hydrocarbons

EXPLORATION AND DEVELOPMENT ASSUMPTIONS: The hypothetical scenarios concerning exploration and development activities for Alternative V were developed using the same assumptions as in Alternative I (Section IV.D.1.a). The level of offshore and onshore activities are based on the amount of hydrocarbon resources assumed to be leased, developed, and produced as a result of sales in Alternative V (see Tables IV.D.5-2 and IV.D.5-3).

TRANSPORTATION AND MARKET ASSUMPTIONS: The amount of natural gas and oil resources assumed to be leased and developed in the Eastern Gulf of Mexico, Chukchi Sea, and Mid- and South Atlantic Planning Areas is less for this alternative than for the proposal (Alternative I). The basic assumptions concerning how oil and gas production will be transported to shore in the base case (Section IV.D.1.a) are still valid. It is also assumed that the amount of natural gas and oil that would be forgone as a result of the adoption of Alternative V would be replaced by the importation of

Table IV.D.5-2. Exploration And Development Activity — Establish Coastal Buffers

Planning Area	Sales (No.)	BBOE	MPHC	Exp./Del. Wells (No.)	Dev./Pro. Wells (No.)	Platforms (No.)	Years Of Activity
Western Gulf of Mexico	5	.85	1.00	1000	540	50	1993-2030
Central Gulf of Mexico	5	1.57	1.00	1380	980	110	1994-2031
Eastern Gulf of Mexico (Part A)	2	.04	0.98	60	26	4	1998-2036
Beaufort Sea (Part C-1)	2	.52	0.16	12	70	3	1994-2021
Beaufort Sea (Part C-2)	2	.52	0.16	12	70	3	1994-2021
Chukchi Sea (Part C-1)	2	1.88	.21	45	251	7	1995-2025
Chukchi Sea (Part C-2)	2	2.01	.21	47	268	7	1995-2025
Hope Basin (Part F) *or*	1	.24	<0.01	8	34	1	1996-2021
St. George Basin (Part D)	1	.23	0.02	8	50	1	1996-2021
Norton Basin (Part E) *or*	1	.30	<0.01	11	66	1	1997-2022
St. Matthew-Hall *or*	1	<.01	<0.01	6	—	—	1997-1999
Navarin Basin	1	.24	0.03	8	48	1	1997-2022
Cook Inlet	1	.16	<0.01	6	26	1	1995-2019
Gulf of Alaska (Part B)	1	.34	0.04	11	53	1	1996-2021
Southern California (Part H)	1	.43	1.00	20	120	6	1998-2030
Mid- and South Atlantic (Part G)	2	.43	0.63	32	97	5	1995-2024

MPHC - Marginal Probabilty Of Commercial Hydrocarbons
BBOE - Billion Barrels of Oil Equivalent

foreign oil by tankers (see Section IV.D.2). The likely mix of market-driven replacements for the forgone hydrocarbons is shown in Table IV.D.2-1. The imported oil replacing the forgone OCS crude oil and natural gas would represent approximately 260 trips by a 100,000 dwt tanker to ports in the Gulf of Mexico Region, approximately 110 trips by a 100, 000 dwt tanker to ports in the Southern California Planning Area, and approximately 110 trips by a 30,000 dwt tanker to ports in the Atlantic Region.

OIL SPILL ASSUMPTIONS:

Oil Spills Greater Than or Equal to 1,000 bbl. Table IV.D.5-4 presents the number and type of oil spills assumed to occur as a result of OCS activity associated with Alternative V. The source and number of assumed spills were based on the volume of oil listed in Table IV.D.5-1, assumptions on the mode of transportation and spill rates for spills greater than or equal to 1,000 bbl (see Section IV.D.1.a). Table IV.D.5-5 presents the probabilities of one or more spills of 1,000 bbl or greater and 10,000 bbl or greater occurring. These probabilities are based on the total estimated mean number of spills assumed to occur as a result of oil production from the adoption of Alternative V.

Table IV.D.5-6 presents the assumed locations of the tanker spills along the tanker routes. Tanker spills resulting from production in the Beaufort and Chukchi Sea Planning Areas are assumed to occur outside of those planning areas. Oil produced in the Beaufort and Chukchi Sea Planning Areas would be transported by the TAPS to the Valdez terminal facilities and then transported by tanker to west coast ports. Based on the destination and amount of the TAPS oil shipped from Valdez to west coast ports (Puget Sound, Washington; San Francisco and Los Angeles, California), it is reasonable to assume that a tanker spill could occur along the tanker routes to these ports).

Table IV.D.5-3. New Offshore and Onshore Infrastructure — Establish Coastal Buffers

Planning Area	Platforms (No.)	Oil and Gas Pipelines[3,6,7,8] (No.)	Oil and Gas Pipelines [7,9] (Miles)	Pipeline Landfalls (No.)	Shore Bases/ Support Facilities (No.)
Western Gulf of Mexico	50	–	1020	2	2[1]
Central Gulf of Mexico	110	–	1240	2	2[2]
Eastern Gulf of Mexico (Part A)	4	–	340	–	–
Beaufort Sea (Part C-1)	3	–[4]	275	1	1[5]
Beaufort Sea (Part C-2)	3	–[4]	275	1	1[5]
Chukchi Sea (Part C-1)	7	–[4]	250	1	1[5]
Chukchi Sea (Part C-2)	7	–[4]	250	1	1[5]
Hope Basin (Part F) *or*	1	1	90	1	1[5]
St. George Basin (Part D)	1	–	–	–	1[5]
Norton Basin (Part E) or	1	–	–	–	–[5]
St. Matthew-Hall *or*	–	–	–	–	1
Navarin Basin	1	–	–	–	–
Cook Inlet	1	1	25	1	1[5]
Gulf of Alaska (Part B)	1	1	100	1	1[5]
Southern California (Part H)	6	12	43	–	–
Mid- and South Atlantic (Part G)	5	3	500	3	6[10]

1. Gulf of Mexico Region - additional support facilities: 2 new marine terminals.
2. Gulf of Mexico Region - additional support facilities: 1 new marine terminal and 1 new pipeline yard.
3. Alaska Region - oil pipelines only.
4. Alaska Region - offshore gathering system.
5. Shorebases can include tank farms, docks, air bases, utilities, supply depots and personnel quarters.
6. Pacific Region - total number of oil and gas pipelines.
7. Pacific and Gulf of Mexico Regions - oil and gas pipelines are layed along the same pipeline corridor.
8. Atlantic Region - gas pipelines only.
9. Atlantic Region - total pipeline miles includes gathering and trunk lines.
10. Atlantic Region - additional support facilities: 2 new gas plants, 2 new heliports and 2 supply bases.

The probabilities of one or more pipeline or platform spills equal to or greater than 1,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 46 percent and 91 or 92 percent, respectively. The probabilities of one or more pipeline or platform spills equal to or greater than 10,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 19 percent and 54 or 57 percent, respectively. As a result of the transportation of oil from the Chukchi Sea Planning Area, there is a 91 or 93 percent probability of one or more spills of 1,000 bbl or more occurring. As a result of the transportation of oil from the Chukchi Sea Planning Area, there is an 80 or 81 percent probability of one or more spills 10,000 bbl or more occurring. As a result of the transportation of oil from the Beaufort Sea Planning Area, there is a 46 percent probability of one or more spills of 1,000 bbl or more occurring. As a result of the transportation of oil from the Beaufort Sea Planning Area, there is a 36 percent probability of one or more spills 10,000 bbl or more occurring.

Table IV.D.5-4. Oil Spill Assumptions — Establish Coastal Buffers

Planning Area	Assumed Oil Spills[3] Platform (Nos.)	Pipeline (Nos.)	Tanker (Nos.)
Western Gulf of Mexico	–	1	–
Central Gulf of Mexico	1	1	–
Eastern Gulf of Mexico (Part A)[1]	–	–	–
Beaufort Sea (Part C-1)	–	1	1
Beaufort Sea (Part C-2)	–	1	1
Chukchi Sea (Part C-1)	1	1	3
Chukchi Sea (Part C-2)	1	2	3
Hope Basin (Part F) or	–	–	1
St. George Basin (Part D)	–	–	1
Norton Basin (Part E) *or*	–	–	1
St. Matthew-Hall[2] *or*	–	–	–
Navarin Basin	–	–	1
Cook Inlet	–	–	1
Gulf of Alaska (Part B)	–	–	1
Southern California (Part H)	–	1	–
Mid-and South Atlantic (Part G)[1]	–	–	–

1. No spill was assumed — total estimated mean number of spills was 0.12 - Mid- and South Atlantic; <0.01 - Eastern Gulf of Mexico
2. No spill was assumed — exploration activity only.
3. Based on the total estimated mean number of spills greater than or equal to 1,000 bbl.

As a result of the importation of foreign oil to replace the forgone OCS natural gas and oil, it was assumed that one tanker spill greater than or equal to 1,000 bbl would occur in the Gulf of Mexico Region. Since the estimated mean number of spills associated with the importation of foreign crude oil was less than 0.03 for the Atlantic Region and was less than 0.09 for the Pacific Region, no spill was assumed for these imports. It is assumed that the substitute import spills and spills assumed to occur as a result of Alternative V would occur with uniform frequency over the life of the alternative.

Oil Spills Greater Than 1 bbl and Less Than 1,000 bbl. Table IV.D.5-7 presents the estimated mean number of spills of less than 1,000 bbl assumed to occur as a result of the adoption of Alternative V. Section IV.D.1.a presents the assumptions used in the calculation of small spills.

Table IV.D.5-5. Oil Spill Probabilities — Establish Coastal Buffers

Planning Area	Oil (BBO)	MP_{HC}	Probability of 1 or more spills occurring 1,000 bbl or greater	 10,000 bbl or greater
Western Gulf of Mexico	0.23	1.00	28%	10%
Central Gulf of Mexico	0.57	1.00	52%	22%
Eastern Gulf of Mexico (Part A)	0.02	.98	3%	< 1%
Beaufort Sea (Part C-1)	0.52	0.16	73%	48%
Beaufort Sea (Part C-2)	0.52	0.16	73%	48%
Chukchi Sea (Part C-1)	1.88	0.21	99%	91%
Chukchi Sea (Part C-2)	2.01	0.21	**%	96%
Hope Basin (Part F) *or*	0.24	<0.01	47%	27%
St. George Basin (Part D)	0.23	0.02	34%	21%
Norton Basin (Part E) *or*	0.30	<0.01	41%	25%
St. Matthew-Hall *or*	<0.01	<0.01	—	—
Navarin Basin	0.24	0.03	34%	21%
Cook Inlet	0.16	<0.01	34%	18%
Gulf of Alaska (Part B)	0.34	0.04	59%	34%
Southern California (Part H)	0.26	1.00	28%	10%
Mid-and South Atlantic (Part G)	0.07	0.63	11%	6%

**probability of one or more spills occurring is greater than 99.5%

BBO - Billion Barrels of Oil

Table IV.D.5-6. Oil Spill Assumptions — Establish Coastal Buffers Assumed Location of Tanker Spills

Location of the Tanker Spill Planning Area	Assumed Tanker Spills (Nos.)
Hope Basin *or*	1
St. George Basin	1
Norton Basin *or*	1
Navarin Basin	1
Cook Inlet	1
Gulf of Alaska	2
Washington and Oregon	1
Northern California	1
Southern California	1

Table IV.D.5-7. Small Spill Assumptions — Establish Coastal Buffers

Planning Area	Assumed Small Spills $>1\leq 50$ bbl[1]	Assumed Small Spills $>50<1{,}000$ bbl[2]
Western Gulf of Mexico	31	1
Central Gulf of Mexico	77	3
Eastern Gulf of Mexico (Part A)	3	–
Beaufort Sea (Part C-1)	132	5
Beaufort Sea (Part C-2)	132	5
Chukchi Sea (Part C-1)	477	19
Chukchi Sea (Part C-2)	515	19
Hope Basin (Part F) *or*	61	2
St. George Basin (Part D)	58	2
Norton Basin (Part E) *or*	76	3
St. Matthew-Hall *or*	–	–
Navarin Basin	61	2
Cook Inlet	41	2
Gulf of Alaska (Part B)	86	3
Southern California (Part H)	19	1
Mid-and South Atlantic (Part G)	18	1

Small Spills Rates per billion bbls of oil produced:

1. Gulf of Mexico Region - 135; Alaska and Atlantic Regions - 253.63; Pacific Region - 72.65
2. Gulf of Mexico Region - 5 ; Alaska and Atlantic Regions - 10.25; Pacific Region - 2.14

a. Impacts on Water Quality

(1) Gulf of Mexico Region

As a result of this alternative, it is estimated that there will be less OCS activities (including discharges) than in Alternative I because the reduced resource discovery and production. The greatest reduction in offshore exploration and production and associated infrastructure support would occur offshore Florida. Offshore Florida, with a 30-mile buffer up to 50 percent (34%-50%) of the activities estimated to support the alternative would be forgone, along with a similar percentage of associated discharges and bottom disturbing activities (an estimated 0.21 million yd^3 of disturbed sediments). Immediate effects would be brought about by increased drilling, construction and pipelaying activities, causing an increase in water column turbidities (lasting for hours several with mud discharges to several weeks with dredging-pipelaying) to the affected offshore waters. The magnitude and extent of turbidity increases would depend on the hydrographic parameters of the area, nature and duration of the activity, and bottom-material size and composition.

As in Alternative I analysis, offshore Texas would receive the greatest portion of program-related pipeline burial activities, whereas, offshore Louisiana would receive the largest amounts of program-related operational discharges. Because of the continuous nature of oil and gas activities in the northwestern and northcentral Gulf of Mexico, the frequency of drilling mud and cutting and produced water discharges is judged to occur nearly continuously throughout these areas. Produced water discharges (approximately 1.7 billion bbl) will be rapidly diluted offshore within the immediate vicinity of the discharge source. Measurable increases in water concentrations of dissolved and particulate hydrocarbons and trace metals are not expected outside the initial mixing zone or immediate vicinity of the discharge source. Another 218 million bbl of produced waters will be transported ashore for separation, treatment, and disposal. Higher concentrations of trace metals, salinity, temperature, organic compounds, and radionuclides, and lower dissolved oxygen may be present near the discharge source. Long-term effects to water column processes, consisting of localized increases in particulate metal and soluble lower molecular weight hydrocarbons (e.g., benzene, toluene, and xylenes) concentrations, may be implicated within the mixing zone of the discharge. Trace metals and hydrocarbons associated with the discharge may be deposited within sediments near the discharge point. The discharge of about 22.25 million bbl of drilling fluids and 6.55 million bbl of drill cuttings would encounter rapid dispersion in marine waters. Discharge plumes will be diluted to background levels within a period of several hours and/or within several hundred meters of the discharge source. The accumulation of toxic trace metals and hydrocarbons in exposed shelf waters, due to periodic releases of water-based generic muds and cuttings, are unlikely and the long-term degradation of the water column from such discharges are not major concerns. Eighteen percent or 5 million bbl of drilling fluids (muds) would be transported onshore for disposal.

Four oil spills (greater than or equal to 1,000 bbl) would occur from program-related activities and increased import tankering due to decreased domestic production. Based on the resource estimates and historic spill rates, no spills greater than or equal to 1,000 bbl are assumed to occur in association with proposed activities offshore northwest Florida. The projected import tanker spill is assumed to occur offshore Texas (Galveston) and would not contact the Gulf's coastline. One oil pipeline spill of 25,000 bbl is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Booming would serve to preclude impacts to estuarine waters there. No oil spills greater than 50 bbl and less than 1,000 bbl are expected to impact coastal and nearshore waters. However, several spills (greater than one and less than or equal to 50 bbl) are likely to result from OCS program-related activities both in the coastal zone and from offshore. Few of these offshore spills will contact the Gulf's coastline. Program-related spills will introduce oil into nearshore waters, creating elevated hydrocarbon levels (up to 100+ug/l) within affected waters. Much of the oil will be dispersed throughout the water column over several days to weeks. In shallow areas, oil may become entrained in suspended particles and bottom sediments. Water uses would be affected for up to several weeks from proposed spills and then only near the source of the slick.

CONCLUSION: As a result of this alternative, an identifiable change to the ambient concentration of one or more water quality parameters will be evident up to several hundred meters from the source and for a period lasting up to several weeks in duration in marine and coastal waters. In restricted coastal waterbodies, this change (in trace metals and hydrocarbons) may exceed USEPA safe levels by several orders of magnitude and persisting for months or longer. Chronic, low level pollution related to the alternative will occur throughout the 45-year life of the alternative.

(2) Alaska Region

Routine activities associated with Alternative V (Established Coastal Buffer) that are likely to affect water quality are drilling and production discharges (muds and cuttings, formation waters) and construction activities (dredging, siting, and platform removal). The major discharges resulting from exploration and production drilling would be muds and cuttings. About 90 exploration and delineation wells and 500 production wells are assumed to be drilled in the Alaskan OCS as a result of Alternative V. The number of wells drilled and discharges of muds and cuttings for the Beaufort Sea, Navarin Basin, Norton Sound (Yukon Delta Deferral), St. George Basin (St. George Buffer Deferral), Hope Basin (Point Hope Polynya Deferral), Cook Inlet, and the Gulf of Alaska (Fairweather Ground/Dry Bay Deferral) would be the same as indicated for Alternative I. Alternative V (Part C-1) would decrease the number of exploration/delineation and production wells drilled in the Chukchi Sea Planning Area. Exploration discharges are not likely to exceed applicable water-quality criteria outside of a 100-m radius, or 0.03 km^2 around each drill site. The effects of exploration discharges on water quality would persist for a few hours within the 100-m radius mixing zone around each platform. The maximum area temporarily degraded at one time in the Beaufort Sea, Navarin Basin, Norton Sound, St. George Basin, Hope Basin, Cook Inlet, and the Gulf of Alaska would be the same as Alternative I. The maximum area temporarily degraded at one time in the Chukchi Sea would be about 0.15 km^2 (1998-1999). Alternative V discharges of muds and cuttings would degrade water quality on less than 1 percent of each planning area.

Production drilling discharges would be of the same order of magnitude as exploration discharges assuming that maximum discharge rates are limited by USEPA to the same extent during production as in exploration.

Over the life of the field, the volume of formation waters produced is equal to 20 to 150 percent of the oil-output volume (Collins et al., 1983). The production of formation waters over the life of the fields in the Beaufort Sea, Navarin Basin, Norton Sound, St. George Basin, Hope Basin, Cook Inlet, and the Gulf of Alaska would be the same as Alternative I. In the Chukchi Sea, the volume of formation waters discharged would range from 376 to 2,820 MMbbl with this alternative (Part C-1).

If formation waters were reinjected or injected into different formations, no discharge of formation waters would occur and no effect would occur. If treated formation waters were discharged, the effect on water quality would be limited to the mixing zone (100 m from the discharge point) and would continue for the duration of production in each planning area. Under Alternative I, the discharge of formation waters would degrade water quality on less than 1 percent of each planning area. Discharge of formation waters would require a USEPA permit and would be regulated so that water-quality criteria, outside an established mixing zone, would not be exceeded.

Trace-metal concentrations in muds and cuttings discharges and oil and grease concentrations in formation water discharges are not likely to exceed water-quality criteria outside a 100-m radius around each drill site or production platform. The discharge of muds and cuttings and formation waters would reduce water quality on considerably less than 1 percent of the area identified under the alternative. This reduction in water quality would exist only during periods of actual discharge and would rapidly dissipate on completion of their discharge. This alternative (Part C-1) would reduce the amount of muds and cutting and formation waters discharged under Alternative I in the Chukchi Sea Planning Area.

Sediment resuspension and bottom disturbances are likely to occur as a result of siting and removing platforms and trenching and burial of subsea pipelines. The amount of sediment disturbance associated with platform siting, anchor setting, and drilling would be comparatively small with sediment levels likely to be reduced to background levels within several hundred meters downcurrent.

This alternative would not reduce the amount of offshore pipeline necessary to tie into assumed existing infrastructure in the Beaufort Sea, Chukchi Sea, Hope Basin, Cook Inlet, or the Gulf of Alaska. Trenching and dumping of dredged spoils would disturb about 17 mi^2 in the Beaufort Sea, 15 mi^2 in the Chukchi Sea, 5 mi^2 in the Hope Basin, 2 mi^2 in the Cook Inlet, and 6 mi^2 in the Gulf of Alaska.

Because dredging occurs at a rate of about 1.3 km/day, the extent of the turbidity plumes from this construction would be about 3.9 km^2 at any one time (a 1.3-km by 3-km area). Over the actual period of pipeline dredging (Beaufort Sea, 3 years; Chukchi Sea, 4 years; Hope Basin, 1 year; Cook Inlet, 1 year; Gulf of Alaska, 1 year), perhaps an equal area would be affected by turbidity from dumping on a daily basis. Dumping of dredged spoils is not expected to introduce or mobilize any chemical contaminants.

In addition to permitted discharges, accidental oil spills are likely to occur. One spill of 1,000 bbl or greater is assumed in the Beaufort Sea Planning Area; two in the Chukchi Sea Planning Area; one spill each in the St. George Basin, Navarin Basin, and Cook Inlet Planning Areas; and two in the Gulf of Alaska Planning Area. Under this alternative there is assumed one less 1,000-bbl-or-greater spill in the Chukchi Sea (Part C-2) than under Alternative I. In addition to the infrequent occurrence of large spills, over 496 chronic small spills ranging from 1 to 999 bbl also are assumed.

Sustained degradation of water quality to levels above State and Federal criteria from hydrocarbon contamination is unlikely. Hydrocarbon concentrations from each of eight oil spills of greater than 1,000 bbl could exceed the chronic criterion of 0.015 ppm total hydrocarbons on up to several thousand square kilometers for a short period of time (about 30 days). However, this would depend on the size, location, and season of the spill. The persistence of individual oil slicks would be short term (less than 1 year). The small spills under 1,000 bbl estimated to occur over the life of the fields would result in local chronic contamination. The potential impacts of two coastal buffers identified for the Chukchi Sea were found to cause the same expected impacts. There are two principal reason for this: the activities that are assumed to occur under each buffer alternative are essentially the same, and the mitigation potential provided by the buffers is largely duplicated by measures that are already included as part of the alternative.

CONCLUSION: Based on the assumptions for Alternative V, trace metal and oil and grease concentrations in discharges are not likely to exceed water-quality criteria outside a 100-m radius around each drill site or production platform. Discharges would reduce water quality on considerably less than 1 percent of the affected area. This reduction in water quality would exist only during periods of actual discharge and would rapidly dissipate on completion of their discharge. Water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for a short period of time (about 30 days). The principal cause of impacts is spilled oil, and there is an 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 24- to 32-year life of the alternative in the Alaska Region.

(3) Pacific Region

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for the base case, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur remain the same as in Alternative I, although the probability of one or more oil spills of 1,000 bbl or more occurring as a result of production in the Southern California Planning Area. Consequently, impacts on water quality in the Pacific Region under Alternative V (Part H) would be somewhat lower than in Alternative I. Section IV.D.1.a(1) provides a discussion of potential impacts on water quality in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine operational effluents include 1) formation, or produced water; 2) drilling muds and cuttings; and 3) other routine discharges such as ballast water, cooling water, desalinization brine, excess cement, deck drainage, and treated sewage. Resuspension of bottom sediments will also occur during most routine operations. Since the numbers of exploratory and production wells assumed to be drilled decrease under this alternative (from 25 and 150 to 20 and 120, respectively), the volumes of produced water and drilling muds and cuttings expected to be discharges would also be reduced. A total of about 30 million bbl of formation water would be discharged from the 120 development and production wells estimated for Alternative V (Part H). Approximately 425,000 bbl of drilling muds and 255,000 bbl of cuttings would be discharged into the sea from the 140 exploratory and development wells assumed to be drilled under this alternative. Effluents and resuspended sediments resulting from routine activities in the Pacific Region are expected to cause some mortality of immobile marine organisms within 300-500 m of discharge sites as a consequence of burial and elevated levels of contaminants and turbidity above ambient levels within 1,000-2,000 m.

Three oil spills (greater than or equal to 1,000 bbl) are assumed to occur in the Pacific Region under this alternative: one off the coast of Washington, one off northern California, and one off southern California. Accidental oil spills are expected to elevate hydrocarbon levels up to 100+ug/l and to limit water use in areas of 1,000-2,000 km^2 over a period of several days to weeks.

CONCLUSION: Adoption of Alternative V (Part H) is expected to result in effects on water quality and water use over areas of a thousand square kilometers or more for periods of days to weeks. Accidental oil spills are expected to be the major cause of impacts.

(4) Atlantic Region

Water quality impacts caused by routine OCS activities are described in Alternative I (see Section IV.D.1.a(1)), where it was concluded that offshore water quality parameters would be affected in the immediate vicinity of discharges and would return to ambient conditions within a few hours after discharges cease. Activities at onshore support bases were also determined to have insignificant effects on inshore water quality. Under the scenario for Alternative V, which is described in this section, OCS leasing will be considered for blocks located more than 80 km (50 mi) from shore. This eliminates potential impacts on water quality from activities at blocks located near the Outer Banks of North Carolina.

Causes of impacts on water quality resulting from routine onshore and offshore OCS activities are described in Alternative I (Section IV.D.1.a(1)). These causes include routine activities, construction, and maintenance at onshore support facilities, gas processing plants, and offshore wells and platforms. Discharges from offshore support vessels while in coastal waters, construction of gas pipelines, and channel dredging are other activities affecting inshore water quality. Water pollution offshore is likely to be caused by discharges of drilling muds and cuttings, formation water, domestic and sanitary wastes, and sediment disturbance associated with deploying and construction of offshore platforms.

The effects on water quality from the discharge of drilling muds and cuttings are determined by depth of discharge, composition of drilling muds, and the amount of muds discharged (Table IV.A-1). The most significant factor affecting these properties, as described in Alternative I (Section IV.D.1.a(1)), is the drilling stage.

A decrease in total assumed discharges offshore, is expected as a consequence of the exclusion of 150 blocks from OCS leasing. In addition, because potential drilling sites will be more than 80 km (50 mi) from shore, offshore discharges are less likely to affect onshore water quality.

Small operational oil spills are a major cause of temporary and local water quality degradation in inshore waters. The principal factors affecting water quality from oil spills are discussed in Alternative I (Section IV.D.1.a(1)). These factors include type of oil (e.g. fuel oil or crude oil) and location of spills. Oil with higher volatile fractions are likely to have the greatest effect on water quality. However, the persistence of oil in the marine environment and, therefore, the prolongation of impacts on water quality is greater for less volatile hydrocarbons, and also depends on environmental factors such as sea and air temperature, and ocean currents and turbulence.

The potential impacts on water quality from routine inshore and offshore discharges associated with OCS activities are discussed in Alternative I (Section IV.D.1.a(1)). Attributes of water quality that are likely to be affected by routine discharges include DO, COD, BOD, turbidity, trace metals (including heavy metals), nutrients, salinity, radionuclides, and toxic chemicals.

The effects of routine discharges on water quality on the OCS are expected to be limited to the vicinity of the discharge (1,000 m [3,280 ft]) and are likely to affect water quality parameters for a few hours or less. The impact of discharges on water quality will be low because of USEPA's NPDES limitations on domestic, sanitary, and drilling discharges, the rapid dilution and dispersion of discharge in the marine environment, and the relatively low toxicity of allowable discharges. The USEPA, through the NPDES restrictions of the Clean Water Act, requires the use of drilling muds that have been tested and approved, and prohibits the discharge of drilling muds and cuttings containing visible oil.

The impact on water quality from the discharge of drilling muds and cuttings are analyzed in Alternative I (see Section IV.D.1.a(1)). The magnitude of currents and turbulence in the water column determines the rate at which drilling muds disperse and their effects on water quality. Effects of turbidity extend approximately 800-1,000 m (2,624-3,280 ft) beyond the discharge site.

The effects on water quality from the discharge of formation waters are analyzed in Alternative I (Section IV.D.1.a(1)). Formation waters dilute rapidly in seawater and their effect on water quality is limited to the immediate vicinity of the discharge site. In addition, the USEPA's NPDES regulations prohibit the discharge of formation water if it contains visible oil.

The impact of domestic and sanitary wastes on water quality are analyzed in Alternative I (Section IV.D.1.a(1)). The effect of these waste discharges on water quality is restricted to the immediate vicinity of the discharge site and is likely to dissipate within a few hours. As with formation waters, the discharge of such wastes offshore are regulated by the USEPA's NPDES permit system. Inshore and offshore construction are likely to temporarily affect water quality by increasing turbidity. Effects of turbidity inshore on water quality were analyzed in Alternative I (Section IV.D.1.a(1)). Burying of gas pipelines and the construction of a gas processing plant are expected to generate turbidity and possible release of heavy metals from sediments. The effects of increased turbidity on water quality are likely to last a few hours to a few days, depending on circulation and sediment composition within the estuary.

Accidental discharges of small oil spills are expected to have a serious effect on water quality. Since most small oil spills are likely to consist of fuel oil which are highly volatile, small oil spills are likely to affect water quality for relatively short time periods (a few hours to days) depending on size of spill, volume of estuary, and tidal exchange. However, because of the high toxicity of fuel oil, these spills are expected to have a major, although short-term (few days) impact on water quality. Factors such as turbulence and the amount and type of suspended sediment can extend the impact of fuel oil spills on water quality from days to months. The effects of routine OCS discharges in the mid- and south Atlantic are not likely to substantially affect onshore or offshore water quality. The most severe effects on water quality are expected to be limited to the immediate vicinity of the discharge site and would persist for not more than a few hours. More significant effects on water quality are likely from inshore fuel oil spills.

CONCLUSION: Water pollution from routine OCS gas and oil activities under the scenario for Alternative V will not seriously degrade water quality onshore or offshore. Some water quality parameters including, turbidity and hydrocarbons, are expected to be locally elevated one or two orders of magnitude for a few days or less.

b. Impacts on Air Quality

(1) Gulf of Mexico Region

Under this alternative, emissions of the five primary pollutants will be about 98 percent of those estimated for Alternative I. Emissions from OCS offshore activities in the northwestern and northcentral Gulf represent approximately 98 percent of the total emissions estimated; whereas those for offshore Florida represent approximately 2.6 percent of this number. Selection of this alternative over Alternative I would not reduce emissions estimated for offshore the northwestern and northcentral Gulf; however, it would reduce emissions from offshore Florida by 46 percent for the 30-mile buffer. Emissions will be greatest in the northwestern and northcentral Gulf based on OCS development trends. Total emissions of the five primary pollutants from proposed new wells, platforms, and vessels range from 23,000 to 329,000 metric tons over the 45-year life of the program. New wells will contribute mostly NO_X; platforms mostly NO_X, CO, and VOC; and vessels will contribute all pollutants. During the early years of activity, emissions would be small and increase over time as production increases. After reaching a maximum, emissions will decrease rapidly to zero as the proposed scenario assumes all platforms will be removed and service vessel trips are no longer needed.

For spills (greater than or equal to 1,000 bbl), emissions are of order 285 tons/hour or less. Concentrations reaching onshore areas from these spills would be on the same level as before based on the dispersion, limited input of pollutants to the atmosphere, and transport regime present. The emissions from the oil spills will last until all the volatile compounds are evaporated, and this takes about three days. About four percent of OCS crude-oil production is offloaded from surface vessels at ports off Texas and the northern coast of the Gulf. Off Florida, up to 25 percent of the OCS production would be offloaded from surface vessels. The unintentional emissions from offloading operations are unknown, but are estimated to be negligible (von Bodungen, pers. comm., 1988) in the northern coast of the Gulf. Off Florida, all emissions from offloading crude would be negligible because the estimated crude oil production will be small.

CONCLUSION: Emissions of pollutants into the atmosphere from the activities assumed for this alternative are expected to have concentrations that would not change onshore air quality classifications. Onshore concentrations of air pollutants from the proposed program-related emissions are estimated to be near 1 ug/m^3 (annual average). Overall, the air quality status in the Gulf of Mexico will not change because of the emissions from activities of this alternative.

(2) Alaska Region

Virtually all phases of activities—exploration, development, and production—have emissions with potential to change the concentration of pollutants in the ambient air. Emissions are the result of the burning of fuel in diesel engines or turbines for the generation of electricity.

Accidental emissions result from gas blowouts, evaporation of spilled oil, and burning of spilled oil. One spill of 1,000 bbl or more is assumed for the Beaufort Sea and one (Part C-2) or two (Part C-2) for the Chukchi Sea from pipelines or platforms. Spills from tankers are assumed in the other areas similar to that of Alternative I.

Estimates of emissions that could affect onshore ambient air quality are based on fuel consumption from diesel engine and turbine generation of shipboard and platform electricity. Electricity consumption is based primarily on the number of exploration, delineation, and production wells and their depth, and the annual oil-production rate. This information is used to prepare an estimate of annual emissions of criteria pollutants for the peak year of exploration development and production phases for Alternative I. The analysis follows for Alternative V with a comparison of emissions for Alternative I.

Table IV.D.5-8 identifies the peak activities and periods for drilling, platform installation, and production for each planning area for Alternative V.

Table IV.D.5-8. Drilling, Platform Installation and Production for Peak Years

Planning Area	Exploration Wells No. (yrs)	Delineation Wells No.(yrs)	Platform No. (yrs)	Oil Production MMbbl (yrs)
Beaufort Sea (Part C-1)	3 (1995)	20(2000)	1 (1999)	43(2005-2006)
Beaufort Sea (Part C-2)	3 (1995)	20(2000)	1 (1999)	43(2005-2006)
Chukchi Sea (Part C-1)	8 (1996,1999,2000)	68 (2005)	2 (2002)	158(2008-2010)
Chukchi Sea (Part C-2)	8 (1996)	68 (2005)	2 (2002)	169(2008-2010)
Navarin Basin	3 (1998,1999)	14 (2003,2004)	1 (2001)	20 (2005-2009)
St. George Basin (Part D)	3 (1997,1998)	14 (2003,2003)	1 (2000)	19 (2004-2008)
Cook Inlet	3 (1996)	14 (2000)	1 (1998)	13 (2002-2006)
Gulf of Alaska (Part B)	4 (1997)	12 (2000)	1 (2000)	29 (2004-2008)

Peak emissions from Alternative V for exploration are estimated to be 33 percent (3 wells) to 80 percent (8 wells) of the total exploration emissions for Part C-2 option. Peak emissions from platforms range from 10 (a single platform) to 1.17 percent (4 platforms in the Chukchi) of the total production emissions for the Part C-2 option. Control measures available for NO_x emissions would result in reductions of 10 to 20 percent for diesel engines (used during exploration) and 70 to 80 percent for gas turbines (used during production). Application of BACT could result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.16 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations.

The timing is expected to be the same as for the scenario for Alternative I. Because of the low level of pollutants in the Alaskan onshore ambient air and continual diffusion of OCS emissions that reach the shoreline, changes in air quality due to OCS emissions will occur only during the time activities are being conducted. Air quality will quickly return to the state it otherwise would have been soon after (weeks to months) OCS activities cease. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions) starting in year 10. Production is expected to occur from years 12 to 30 after the lease sale, with the highest level of production occurring during the first year of development.

The NO_x emissions for diesel engines (during exploration) would result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.16 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions) starting in year 10.

Accidental emissions result from gas blowouts, evaporation of spilled oil, and burning of spilled oil. The scenario for Alternative V assumes one spill of 1,000 bbl or more from pipelines or platforms for the Beaufort and one (Part C-1) or two (Part C-2) for the Chukchi. Two tanker spills of 1,000 bbl or more are assumed along the shipping routes in the Bering Sea and two in the Gulf of Alaska.

Potential accidental emissions are discussed in the scenario for Alternative I. Potential accidental emissions for Alternative V would be about the same as for the scenario for Alternative I. The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last a short period after emissions cease.

CONCLUSION: The NO_x emissions for diesel engines (during exploration) would result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.16 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions) starting in year 10. The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last less than a week after emissions cease.

(3) Pacific Region

Under Alternative V (Part H), the types of routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Because of the deferral of blocks within 12 miles of shore from Morro Bay south to the Santa Maria River mouth the number of routine activities change slightly. There would be 6 platforms instead of 7, 20 exploration and delineation wells instead of 25, and 120 development and production wells instead of 150. The total emissions resulting from Alternative V (Part H) would be less than total emissions resulting from Alternative I. However, estimated emissions for individual operations remain the same. Consequently, impacts on air quality in the Pacific Region would remain unchanged from Alternative I. Section IV.D.1.a(2) provides a discussion of potential impacts on air quality in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

The effects of emissions associated with the six platforms on acid deposition are expected to be negligible. This is based on the expected rate of emissions of NO_2 and SO_2. These emissions are only a small fraction of existing emissions of those pollutants in the southern California area.

It is assumed that one pipeline spill of an estimated 7,000 bbl of oil will occur as a result of the Alternative V (Part H). An event such as this would have the potential to create air quality problems in the vicinity of the spill for the duration of the spill. However, onshore effects are highly dependent on the distance offshore, and weather conditions at the time. Spills greater than 3 miles from shore are unlikely to have long term, measurable effects on onshore air quality.

Three tanker spills of 30,000 bbl each are assumed to occur along the tanker route in the Pacific Region from Alaska production. In the event of a tanker spill, total emissions for each spill during the first and second hour would be 1,710,000 lbs and 870,000 lbs respectively. In the event the spill occurs nearshore, impacts to the Washington and southern California areas could result in short-term exceedance of the onshore standard. Onshore effects would not be discernable for the spill off northern California since it is assumed to be further offshore.

CONCLUSION: Adoption of Alternative V (Part H) is not expected to result in an exceedance of the ambient air quality standards or Prevention of Significant Deterioration increments. Emissions of NO_x and RHC from platforms and vessels are estimated to be less than 5 percent of future projected onshore emissions. Because of the O_3 nonattainment status of all the onshore areas, the Clean Air Act would require emission offsets for all NO_x and RHC emissions from a facility. Any residual emissions from vessels would be small and would not be expected to contribute to a violation of the Federal or State ambient air quality standards for O_3.

In the event of an accidental spill, local air quality standards off the Washington and southern California planning areas in the vicinity of the spill will be temporarily exceeded. These exceedances are expected to last for the duration of a spill, but are not expected to result in long term effects to onshore air quality.

(4) Atlantic Region

Air quality impacts resulting from routine OCS activities are described in Alternative I (see Section IV.D.1.a(2)), where it was concluded that onshore air quality will not be affected by routine OCS activities. Offshore air quality will only be affected in the immediate vicinity of the emissions and only during the time of those emissions. Under the scenario for Alternative V (Part G), which is described in this section, OCS leasing will be considered on blocks located more than 80 km (50 miles) from shore. This eliminates potential impacts on air quality from activities at a group of blocks located near the Outer Banks of North Carolina.

Alternative I analyzes the potential causes of impacts on air quality resulting from routine OCS activities (Section IV.D.1.a). Air pollution emissions will occur both offshore and onshore during routine operations. The well drilling stage, because it determines the type of equipment used, affects the types and amounts of emissions released. The type of emissions generated offshore also depends on the type of hydrocarbons discovered (gas, oil, or both) and the rate of hydrocarbon production. The causes of routine emissions include combustion of diesel fuel by support vessels and drillships, and the combustion of natural gas by turbines on OCS development/production platforms. Pollutants released during the above activities include VOC, NO_x, SO_x, CO, and TSP. H_2S may also be released during gas flaring, well testing, and gas processing including desulfurization.

Potential impacts on air quality from routine emissions offshore are discussed in Alternative I (Section IV.D.1.a). Types and amounts of routine emissions are summarized. Routine emissions from offshore OCS activities will affect air quality in the immediate vicinity of the emissions but will dissipate rapidly after emissions cease due to the direction of prevailing offshore coastal winds. Onshore air quality will not be affected by anticipated activities at OCS drilling sites. A decrease in total potential emissions offshore, over Alternative I, is expected as a consequence of the exclusion of 150 blocks from OCS leasing under the scenario for Alternative V (Part G). In addition, because drilling sites will be more than 80 km (50 miles) from shore, emissions generated offshore under this scenario are expected to affect onshore air quality less and are to be more dispersed by prevailing offshore winds (Section III.D.1).

The effect of onshore emissions on air quality are expected to be the same as those described for Alternative I (Section IV.D.1.a(2)). There will be no change in the number of support bases, gas processing plants, and oil refineries in the scenario for Alternative V. Emissions generated at onshore staging sites will primarily be from the combustion of diesel fuel and therefore, are expected to be similar to emissions generated by equipment currently being used at commercial ports that are likely to be used as staging sites for offshore activities. Gas processing and oil refining at onshore sites will release some pollution products. Potential air pollutants include VOC, TSP, and H_2S. These emissions will be controlled by NAAQS standards, and State and local air quality regulations.

The impact on air quality from small operational oil spills is analyzed in Alternative I (Section IV.D.1.a(2)). Air quality will be diminished by inshore oil spills, but because these spills are assumed to be fuel spills, they will dissipate within a few hours to a few days. For spills occurring on the OCS, the prevailing offshore winds will result in rapid dissipation and no effect on onshore air quality is expected.

Other accidents, including gas blowouts, are likely to reduce air quality as a consequence of the release of H_2S as well as VOC. These gases, however, are unlikely to affect onshore air quality because of the prevailing offshore direction of coastal winds. In addition, due to stringent safety requirements by the MMS, large gas releases from a well or drilling platform are very unlikely.

The effects of routine OCS development in the mid- and south Atlantic under the scenario for Alternative V are not likely to have a measurable effect on onshore air quality. The effects are expected to be similar to those effects on onshore and offshore air quality described in Alternative I scenario. However, since the source of offshore pollution will be no closer than 80 km (50 mi), a decrease in emissions over Alternative I for the 17 year period considered in the scenario for Alternative V is likely. The greatest effects on onshore air quality are expected to occur if there were small accidental spills of fuel oil.

CONCLUSION: Air pollution emissions from OCS gas and oil development under the scenario for Alternative V will not measurably degrade air quality onshore or offshore. Some air quality parameters (such as, NO_x, SO_x, CO, VOC, and TSP) are expected to be locally elevated one or two orders of magnitude for a few days or less during offshore or onshore emissions.

c. Impacts on Marine Mammals

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect endangered and threatened cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to endangered and threatened cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb endangered and threatened cetaceans because of industry's compliance with MMS guidelines and adherence to the FAA recommended minimum ceilings. The effects on endangered and threatened cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on endangered and threatened cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to industry's adherence to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on endangered and threatened cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect endangered and threatened cetaceans. Four assumed oil spills (greater than or equal to 1,000 bbl) from program-related activities and increased import tankering due to decreased domestic production have been described previously. The effect on endangered and threatened cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths affected by spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: Based on the scenario for this alternative, there is expected to be no discernible decline in an endangered or threatened cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil, and the probability ranges from less than 1 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Nonendangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb cetaceans because of prohibitions by the MMS and adherence to the FAA recommended minimum ceilings. The effects on cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to industry's adherence to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect non-endangered and non-threatened cetaceans. Four assumed oil spills (greater than or equal to 1,000 bbl) from program-related activities and increased import tankering due to decreased domestic production have been described previously. The effect on cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths affected by spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: Based on the scenario for this alternative, there is expected to be no discernible decline in a cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil, and the probability ranges from less than 1 to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Alaska Region

(a) Threatened or Endangered Species

1) Cetaceans

a) Bowhead Whale

Effects on bowhead whales from Alternative V could result from routine activities including vessel movements, seismic surveys, dredging, drilling, drillships, pipeline construction, and production operations. All of these activities produce industrial noise that may elicit a response from whales. The effect of industrial noise on endangered whales has been described previously for Alternative I. When these activities occur within 1 to 4 km of whales, most would probably change their swimming direction to avoid them. No change in the overall fall bowhead migration route is expected due to this alternative.

Except for the Chukchi Sea, Alternative V is the same as the Alternative I within the range of the bowhead whale. Hence, the expected effect of this alternative on bowheads would be as described for Alternative I, except for the Chukchi Sea. However, of the activities that could occur in the Chukchi Sea, only production operations in the coastal buffer area have the potential to differ in their effect from that of Alternative I. This is because the fall bowhead migration route through the Chukchi Sea is offshore of the proposed coastal buffer. Hence, the coastal buffer would provide little to no benefit for fall migrating bowheads over that of Alternative I. Also, because the spring bowhead migration will have passed through the coastal buffer area before exploratory operations can commence there, the coastal buffer area would be of little benefit to spring migrating bowheads as well. However, because bowheads use the coastal buffer area during their spring migration, Alternative V would prevent them from encountering production noise in this area, which may occur as part of Alternative I if development and production were to occur there.

Alternative V estimates the drilling of about 300 wells and the placement of seven platforms in the Chukchi Sea and 82 wells and three platforms in the Beaufort Sea, which is similar to the Alternative I scenario. Thus, Alternative V would result in a similar number of probable whale and industrial noise encounters, and therefore, similar effects as discussed for Alternative I. Based on the assumptions discussed for Alternative I, and assuming further that drilling and platform operations occur when whales are migrating through the area, noise associated with Alternative V is estimated to cause up to 30 percent per year of the bowhead population to swim around sources of industrial noise. This estimated encounter rate is 10 percent lower than that of Alternative I, because production platforms associated with Alternative V would be placed farther offshore from the coastal area, which is used by migrating bowhead whales in the spring.

If an oil spill occurred and contacted bowhead whales, effects may include those discussed for Alternative I including inhalation of hydrocarbon vapors, a loss of prey organisms, ingestion of spilled oil or oil-contaminated prey, baleen fouling with a reduction in feeding efficiency for up to a couple of days, and skin and/or sensory-organ damage. Based on the assumptions discussed for Alternative I, and assuming further that the estimated number of oil spills for Alternative V occurred during annual migrations, it is estimated that they would affect up to 10 percent of the bowhead whale population. The Point Hope polynya deferral may reduce these effects, because the polynyas in this area can be used by bowheads in the spring. This would occur in years when the bowheads migrate through the deferral area (depends on annual ice conditions areawide). However, in years when bowheads migrate through ice leads outside the deferral area, the Point Hope polynya deferral would not reduce effects on the spring bowhead migration. Oil contact would be less likely in the Chukchi Sea, because the coastal buffer area would preclude oil-production facilities where bowheads tend to be concentrated in the spring.

CONCLUSION: Based on the scenario assumptions, it is expected that Alternative V would have sublethal effects on up to 30 percent per year of the bowhead population due to noise and up to 10 percent of the population due to oil spills. These effects are more likely to occur in the Beaufort Sea rather than the Chukchi Sea. None of the above sublethal effects on bowhead whales are expected to affect recruitment or distribution of the species. The potential impacts of two coastal buffers identified for the Chukchi Sea were found to cause the same expected impacts. There are two principal reason for this: (1) the activities that are assumed to occur under each buffer alternative are essentially the same, and (2) the mitigation potential provided by the buffers is largely duplicated by measures that are already included as part of the alternative. There is a 22 to 96 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the bowhead whale over the 30-year life of the alternative.

b) Fin and Humpback Whales

Because Alternative V is the same as Alternative I in areas within the range of fin and humpback whales, effects on these species due to Alternative V would be as discussed for Alternative I. Given that the scenarios for the two Chukchi Sea buffer alternatives are essentially the same and that measures to protect coastal resources are already part of the proposed program, no substantive differences between the impacts of these two alternatives were found.

CONCLUSION: Noise associated with Alternative V is estimated to have sublethal effects on up to 20 percent of fin and humpback whale populations each year. Tanker oil spills are estimated to have sublethal effects on up to 10 percent of these species' populations over the 24- to 32-year life of the alternative. None of the sublethal effects are expected to affect recruitment or distribution of these species.

c) Right, Blue, Sei, and Sperm Whales

Because Alternative V is the same as Alternative I in areas within the range of right, blue, sei, and sperm whales, effects on these species due to Alternative V would be as discussed for Alternative I. The potential impacts of two coastal buffers identified for the Chukchi Sea were found to cause the same expected impacts. There are two principal reason for this: (1) the activities that are assumed to occur under each buffer alternative are essentially the same, and (2) the mitigation potential provided by the buffers is largely duplicated by measures that are already included as part of the alternative.

CONCLUSION. Based on the Alternative V scenario, noise is estimated to affect up to 10 percent per year of right, blue, sei, and sperm whale populations. Tanker oil spills are estimated to affect up to 5 percent of these species' populations over the 24- to 32-year life of the alternative. None of the above sublethal effects are expected to affect recruitment or distribution of these species.

2) Pinnipeds

Potentially disturbing activities associated with construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, are expected to decrease in coastal areas adjacent to the Norton Basin, St. George Basin, and Gulf of Alaska Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I.

Removal of industrial activities farther offshore in the Chukchi Sea and Hope Basin is not expected to alter the disturbance of Steller sea lions because of this species' infrequent occurrence in these areas. Deferral of blocks in the Pribilof Islands area is expected to reduce disturbance of sea lions occupying Walrus Island and vicinity, though not significantly. Deferral of blocks in the Yakutat area and Norton Sound is expected to decrease disturbance only slightly from activity in this area due to the small numbers of sea lions likely to be affected. Overall disturbance impacts resulting from this alternative are expected to be approximately the same as Alternative I, requiring no more than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Pribilof area, and to some extent in the Yakutat area, is expected to somewhat reduce the toxic effects of spilled oil by allowing more extensive weathering to occur before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be approximately the same as Alternative I, requiring three or more generations for recovery to original sea lion population status. Potentially, less than 5 percent of the Alaskan sea lion population is expected to be affected by deferrals included in this alternative. In summary, the potential impacts of coastal buffers proposed for the planning areas identified above are expected to be approximately the same as for Alternative I.

CONCLUSION: Overall disturbance of Steller sea lions resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring no more than one generation (3-5 years per operation) for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring three or more generations for recovery. There is an 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the Steller sea lions over the 24- to 32-year life of the alternative.

(b) Nonendangered Species

1) Cetaceans

a) Beluga Whale

Alternative V is expected to reduce the chance of platform oil spills from contacting the Chukchi Sea portion of the Chukchi-Point Barrow ice-lead system south of Peard Bay and from contacting the Point Hope polynya and avoid icebreaker noise and disturbance of beluga whales in this portion of the spring migration corridor. The number of oil spills of 1,000 bbl or greater assumed to occur in the Chukchi Sea Planning Area would be reduced from three to two under this alternative (Part C-1) and the number of small spills assumed to occur in the Arctic would be less than Alternative I. However, beluga whales still are expected to be affected by spills in the Beaufort Sea that contact the lead system offshore of Point Barrow and would be affected by noise and disturbance from icebreakers (operating in the Beaufort Sea) and other vessels associated with this alternative from leasing activities in the Bering Sea and in Cook Inlet.

The deferral of leasing within 12 miles (rather than 9 miles) of the Yukon Delta might slightly reduce whale contact with potential oil spills and slightly reduce boat-traffic disturbance of beluga whales that feed in the river and adjacent coastal waters, but these whales would be exposed to boat traffic in other areas along the Bering Sea coast.

A 30-mile buffer deferral around St. George Island is not expected to reduce effects on beluga whales, because this area is not primary habitat for beluga whales.

The Dry Bay-Fairweather Grounds proposed deferral area is not important habitat for beluga whales in the Gulf of Alaska, and thus effects on the Cook Inlet/Gulf of Alaska beluga whale population are not expected to be reduced by this deferral.

Under this alternative, the primary effects on beluga whales are expected to come from noise and disturbance, especially icebreaking activities, and other marine-vessel traffic and oil spills. Noise and disturbance from icebreakers and other marine traffic are expected to temporarily (a few days to less than 3 years) displace or interfere with beluga whale movements within a few to several miles of the activities. Few beluga whales are likely to die from contact with oil spills. The loss of beluga whales from the seven oil spills (perhaps 100 whales or less) in the Alaskan populations is expected to be less than the losses due to natural mortality such as losses from disease, predation, and subsistence harvest.

CONCLUSION; Based on the scenario, impacts of Alternative V on beluga whales would be less than Alternative I in that portion of the Chukchi Sea-Point Barrow lead system south of Peard Bay in the Point Hope polynya and within 12 miles of the Yukon Delta. However, the effects of oil spills and noise and disturbance on beluga whales in the Beaufort Sea, in the northern portion of the lead system used by the whales during spring migration, and beluga whales in the Bering Sea and Gulf of Alaska (Cook Inlet) are expected to be the same as described under Alternative I.

b) Minke Whale

The establishment of coastal buffers in the Alaska Region under this alternative (Part C-1) will result in a slightly lower number of wells drilled and the assumption of one less large oil spill in the Chukchi Sea. Given the low densities of minke whales in the areas affected (USDOI, MMS, 1987a), potential impacts to this species from routine activities under either version of Alternative V in the Alaska Region (Parts C-1 or Part C-2) are unlikely to decrease measurably from those discussed for Alternative I. These activities include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal.

Concentrations of minke whales have been observed near the Pribilof Islands during summer (Braham and Dahlheim, 1982). However, given the species' relatively low density and wide distribution in the southeastern Bering Sea, impacts to minke whales from routine activities and accidental events under Part D are not expected to change measurably from those described for Alternative I.

Given the low densities of minke whales in the area affected under Part F (USDOI, MMS, 1987a), impacts to this species from routine activities and accidental events are not expected to change measurably from those described for Alternative I.

Due to the very small area proposed for deletion from consideration for future leasing under Part E, impacts to minke whales from routine activities and accidental events are not expected to change measurably from those described for Alternative I.

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline from the Santa Maria River north to Morro Bay Figure II.E.1-9. This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated.

Therefore, potential impacts to minke whales from routine activities under Alternative V (Part H) in the Alaska Region are likely to decrease slightly from those discussed for Alternative I. Section IV.D.1.a(3) provides a discussion of potential impacts on the minke whale population and an analysis of the impacts expected as a result of Alternative I.

As in Alternative I, effects on minke whales from routine activities are expected to be sublethal and temporary in nature, including primarily avoidance reactions and changes in direction at distances up to 5 km from the source. Due to greater levels of construction activities and the construction of four pipelines to the shoreline in the Alaska Region, it is expected that minke whales will be displaced from a few square kilometers of foraging area for one season or less.

The accidental events assumed to occur remain the same as in the Alternative I with the exception of Part C-1 for the Alaska Region where the number of oil spills assumed to occur under this alternative is reduced, and in Part H for the Pacific Region where the probability of one or more spills of 1,000 bbl or more occurring from production in the Southern California Planning Area is decreased to 28 percent. As in Alternative I, it is expected that the oil spills assumed to occur under this alternative will cause no minke whale mortality and will not disrupt migratory movements through the Alaska and Pacific Regions.

CONCLUSION: Adoption of Alternative V is expected to result in sublethal effects on minke whales lasting no more than a few months. No discernable changes in minke whale abundance or distribution are expected.

2) Pinnipeds

a) Northern Fur Seal

Potentially disturbing activities associated with construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, are expected to decrease in coastal areas adjacent to the St. George Basin and Gulf of Alaska Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I.

Moving industrial activities farther offshore in the Chukchi Sea, Hope Basin, and Norton Basin is not expected to alter the disturbance of fur seals because of this species' infrequent occurrence in these areas. Deferral of blocks in the Pribilof Islands area is expected to reduce disturbance of fur seals, though not significantly, because activities disturbing to seals (e.g., helicopter traffic) still may occur in the vicinity of seal-breeding concentrations or summer haulout areas, thereby diminishing the overall reduction in disturbance occurring elsewhere. Deferral of blocks in the Yakutat area is expected to decrease disturbance slightly if at all from activity in this area due to the small numbers of seals likely to be affected. Overall disturbance impacts resulting from this alternative are expected to be approximately the same as Alternative I, requiring less than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area (Part B, Yakutat) is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Pribilof area—and to some extent in the Yakutat area—is expected to somewhat reduce the toxic effects of spilled oil by allowing more extensive weathering to occur before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be approximately the same as Alternative I, requiring one to two generations or more for recovery to the original population status. As under Alternative I, potentially up to 70 percent of the fur seal population is expected to be affected in this alternative. In summary, the potential impacts from coastal buffers proposed for the planning areas identified above are expected to be approximately the same as for Alternative I.

CONCLUSION: Overall disturbance of fur seals resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring less than one generation for recovery to the original population status. Impacts caused by oil spills are expected to be the same as Alternative I, requiring three or more generations for recovery. There is a 14 to 34 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the northern fur seal over the 24- to 32-year life of the alternative.

b) Ice Seals

Disturbance of ice seals caused by construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, is expected to decrease in coastal areas adjacent to the Chukchi Sea, Hope Basin, Norton Basin, and St. George Basin Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I.

Moving industrial activities farther offshore in the Chukchi Sea, Hope Basin, and Norton Basin is expected to reduce disturbance of ice seals, particularly spotted and ringed, from such activities in the deferred coastal areas. However, other activities disturbing to seals (e.g., helicopter traffic) still may occur in the vicinity of seal-breeding concentrations or summer haulout areas, thereby diminishing the overall reduction in disturbance occurring elsewhere. In addition, this alternative could cause the area disturbed by air traffic to expand because support aircraft would be required to fly longer distances to more sites located farther offshore than under Alternative I. Deferral of blocks in the Gulf of Alaska (Yakutat) area is not expected to alter disturbance of these species because they do not occur there, and effect in the Pribilof (St. George Island) area is likely to be minimal due to their small numbers in this area. The overall disturbance impact resulting from this alternative is expected to be approximately the same as Alternative I, requiring less than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Chukchi Sea, Hope Basin, and Norton Basin areas is expected to somewhat reduce the toxic effects of spilled oil by allowing more extensive weathering to occur before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be approximately the same as under Alternative I, requiring up to one generation for recovery.

CONCLUSION: Overall disturbance of ice seals resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring less than one generation for recovery to the original population status. Impacts caused by oil spills are expected to be the same as Alternative I, requiring up to one generation (4-6 years) for recovery. There is a 21 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the ice seals over the 24- to 32-year life of the alternative.

c) Harbor Seal

Potentially disturbing activities associated with construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, is expected to decrease somewhat in coastal areas adjacent to the St. George Island (Pribilof Islands) and Gulf of Alaska (Yakutat) areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I.

Moving industrial activities farther offshore in the Chukchi Sea, Hope Basin, and Norton Basin is not expected to reduce disturbance of harbor seals because of this species' unlikely occurrence in these areas. Deferral of blocks in the Pribilof and Yakutat areas is expected to decrease disturbance from activity in these areas only slightly due to the small numbers of seals likely to be affected. Overall disturbance impacts resulting from this alternative are expected to be approximately the same as for Alternative I, requiring less than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Pribilof and Yakutat areas is expected to somewhat reduce the toxic effects of spilled oil by allowing more extensive weathering to occur before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be approximately the same as Alternative I, requiring one or more generations (4-6 years per generation) for recovery to the original population status.

CONCLUSION: Overall disturbance of harbor seals resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring less than one generation for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring one or more generations for recovery. There is an 18 to 21 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the harbor seal over the 24- to 32-year life of the alternative.

d) Pacific Walrus

Disturbance of walruses caused by construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, is expected to decrease in coastal areas adjacent to the Chukchi Sea, Hope Basin, Norton Basin, and St. George Basin Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I.

Moving industrial activities farther offshore in the areas identified above is expected to somewhat reduce disturbance of walruses from such activities in the deferred coastal area. However, activities disturbing to walruses (e.g., helicopter traffic, icebreakers) still may occur in the vicinity of female-calf nursery herds or summer haulout areas, thereby diminishing the overall reduction in disturbance occurring elsewhere. In addition, this alternative could cause the area disturbed by air traffic to expand because support aircraft would be required to fly longer distances to more sites located farther offshore than under Alternative I. Deferral of blocks in the Yakutat area is not expected to alter walrus disturbance, because they rarely enter the Gulf of Alaska. Overall disturbance impact resulting from this alternative is expected to be approximately the same as Alternative I, requiring less than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Chukchi Sea, Hope Basin, Norton Basin and St. George Basin is expected to somewhat reduce the toxic effects of spilled oil by allowing more extensive weathering to occur before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be reduced somewhat from Alternative I but would still require up to one generation for recovery.

CONCLUSION: Overall disturbance of walruses resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring less than one generation (10-15 years) for recovery to the original population status. Impacts caused by oil spills are expected to be the same as Alternative I, requiring up to one generation for recovery. There is a 21 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the walruses over the 24- to 32-year life of the alternative.

3) Sea Otter (Alaska Population)

Potentially disturbing activities associated with construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, is expected to decrease to a minimal extent in the coastal section of the Yakutat area by restricting the location of industrial sites to areas farther offshore than is assumed for Alternative I.

Moving industrial activities farther offshore in the Chukchi Sea, Hope Basin, Norton Basin, and St. George Basin is not expected to reduce disturbance of sea otters because of this species' unlikely occurrence in these areas. Deferral of blocks in the Yakutat area is expected to decrease disturbance slightly if at all from activity in this area due to the small numbers of sea otters likely to be affected. The overall disturbance impact resulting from this alternative is expected to be approximately the same as Alternative I, requiring no more than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffer in the Yakutat area is expected to reduce the toxic effects of spilled oil to a minor extent by allowing more extensive weathering before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be approximately the same as Alternative I, requiring two generations or more for recovery.

CONCLUSION: Overall disturbance of sea otters resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring no more than one generation (3-5 years) for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring two generations or more for recovery. There is an 18 to 21 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the sea otter over the 24- to 32-year life of the alternative.

4) Polar Bear

Disturbance of polar bears caused by construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, is expected to decrease in coastal areas adjacent to the Chukchi Sea and Hope Basin Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore than is assumed for Alternative I.

Moving industrial activities farther offshore in the Chukchi Sea and Hope Basin is expected to somewhat reduce disturbance of polar bears from such activities in the deferred coastal areas. However, activities disturbing to bears (e.g., helicopter traffic) still may occur in the vicinity of bear-concentration or -denning areas, thereby diminishing the overall reduction in disturbance occurring elsewhere. In addition, this alternative could cause the area disturbed by air traffic to expand because support aircraft would be required to fly longer distances to more sites located farther offshore than under Alternative I. Deferral of blocks in Norton Basin, St. George Basin, and the Gulf of Alaska are not expected to alter disturbance impacts, because polar bears infrequently or never occur in these areas. The overall disturbance impact resulting from this alternative is expected to be approximately the same as Alternative I, requiring less than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Chukchi Sea and Hope Basin areas is expected to somewhat reduce the toxic effects of spilled oil by allowing more extensive weathering before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be reduced somewhat from Alternative I, but still would require one or more generations for recovery.

CONCLUSION: Overall disturbance of polar bears resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring less than one generation (5-8 years) for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring one or more generations for recovery. There is a 21 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the polar bear over the 24- to 32-year life of the alternative.

(3) Pacific Region

(a) Threatened or Endangered Species

1) Cetaceans

GRAY WHALE: Alternative V (Part B) excludes 25 blocks located offshore Yakutat in the Gulf of Alaska Planning Area from consideration for future leasing, but does not change the routine activities or oil spills from those assumed for Alternative I. The alternative also excludes approximately 580 or 1,000 blocks located from the Point Barrow area in the Beaufort Sea Planning Area to the Point Hope area in the Chukchi Sea Planning Area from consideration for future leasing. The establishment of this coastal buffer (Part C-1) will result in a slightly lower number of wells drilled and the assumption of one less oil spill in the Chukchi Sea.

Although a few gray whales summer around the Pribilof Islands each year, the species' major feeding grounds are found in the northern Bering Sea and southern Chukchi Sea (Braham, 1984). Impacts to gray whales from routine activities and accidental events under Part D are not expected to change measurably from those described for Alternative I.

Due to the very small area proposed for deletion from consideration for future leasing under Part E, impacts to gray whales from routine activities and accidental events are not expected to change measurably from those described for Alternative I.

The 42 blocks proposed for exclusion from consideration for leasing under Part F lie within the gray whale's summer feeding range. However, since the proposed levels of routine activities and oil spill assumptions do not change from Alternative I, impacts to gray whales are not expected to change from those described for Alternative I.

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur as a result of Alternative V (Part H) remain the same as Alternative I, however, the probability of one or more spills of 1,000 bbl or greater occurring from production in the Pacific Region decreases to 28 percent. Section IV.D.1.a(3) provides a discussion of potential impacts on the gray whale population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on gray whales include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. The coastal area excluded, approximately 13,500 km^2 or 23,000 km^2, contains most of the important gray whale concentration areas north of Point Hope (USDOI, MMS, 1987d). Gray whales in this area are generally observed within 15 km of shore (Moore et al., 1986). Gray whales would not be exposed to noise and disturbance from seismic surveys, exploration units, or production platforms within this area. Air and vessel support traffic would still pass through the excluded area, and pipeline construction would still occur within the excluded area. Thus, gray whales in this area would still be affected by these activities, although at a lower level than in Alternative I.

As in Alternative I, effects on gray whales from routine activities are expected to be sublethal and temporary in nature, including primarily avoidance reactions and changes in direction at distances up to 5 km from the source. No disruption of gray whale migration through the Alaska and Pacific Regions is expected. In the species' Bering and Chukchi Sea feeding grounds, gray whales may be displaced from areas of a few tens of square kilometers for one season or less during platform or pipeline construction. Some whales may also be excluded from feeding within a few hundred meters of drilling units and production platforms.

The oil spill assumptions for the Pacific Region do not change from Alternative I under this alternative. For the Alaska Region, the number of oil spills assumed to occur under this alternative (Part C-1) is reduced by one spill. As in Alternative I, it is expected that the oil spills assumed to occur along the species' migratory pathway through the Alaska and Pacific Regions will result in no mortality and will not disrupt the gray whale migration.

Three of the oil spills (Part C-2) are assumed to occur in the primary gray whale summer feeding grounds in the northern Bering and Chukchi Seas. As in Alternative I, the occurrence and contact of one such spill during the summer could result in the death of a few individuals and the displacement of animals from an area of up to 1,500 km^2 for all or part of a season. The exclusion of the blocks in the Chukchi and Beaufort Seas (Part C-1) reduces the number of spills assumed to occur in this area by one pipeline spill, slightly reducing the risk to gray whales in the area.

CONCLUSION: The adoption of Alternative V is expected to result primarily in sublethal effects on the gray whale population involving changes in abundance and distribution lasting a year or less. A few mortalities will occur due to accidental oil spills. This level of mortality is not expected to be distinguishable from natural variability within the gray whale population. There is a 14 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the gray whale over the 30-year life of the alternative.

2) Pinnipeds

GUADALUPE FUR SEAL: Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur remain the same as in the Alternative I, however, the probability of one or more spills of 1,000 bbl or more from production in the Southern California Planning Area decreases to 28 percent. Therefore, expected impacts to the Guadalupe fur seal would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the Guadalupe fur seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on Guadalupe fur seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the Guadalupe fur seal population.

Two large spills are assumed to occur off southern California under this alternative. Since a small, undetermined number of Guadalupe fur seals are probably present in these waters at any one time, it is possible that such a spill would contact and kill a few individual fur seals. This level of mortality would not be distinguishable from natural variability within the population.

CONCLUSION: Adoption of Alternative V (Part H) is expected to have no discernable effect on Guadalupe fur seal abundance and distribution.

3) Sea Otter (Pacific Population)

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline in the southern portion of the California sea otter range (from the Santa Maria River north to Morro Bay) (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur remain the same as Alternative I, however, the probability of one or more oil spills greater than or equal to 1,000 bbl occurring from production in the Southern California Planning Area decreases to 28 percent. Expected impacts to the Washington sea otter population would remain the same, because the impacting agents affecting this otter population are unchanged from Alternative I. Impacts to the California sea otter population from accidental events are expected to decrease. Section IV.D.1.a(3) provides a discussion of potential impacts to the sea otter populations in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea otters include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Routine operations associated with the proposed action are not expected to impact the California or Washington sea otter populations.

Three large tanker oil spills are assumed to occur in the Pacific Region under this alternative: one off the coast of Washington, one off northern California, and one off southern California. A large oil spill contacting either the Washington or California sea otter populations would result in mortality and temporary loss of habitat. It is impossible to predict where the oil spills assumed for Alternative I would occur. In the spill scenario for Alternative I, it was assumed for analytical purposes that a pipeline spill of 7,000 bbl. Oil would spread northward approximately 30 km from the Santa Maria River to near Point Buchon.

Under Alternative V (Part H), a pipeline spill would necessarily occur south of the Santa Maria River, since no platform or pipeline would be located north of that point. Any oil spilled would have to travel a greater distance before contacting the sea otter range and, consequently, would be subject to weathering and dispersion processes, as well as cleanup activities, for a longer period of time. As a result, some reduction of impact would be expected.

Assuming a spill occurs and contacts the California mainland sea otter range, it is estimated that up to 13 percent of the population, approximately 250 animals could die, and the recovery of the California sea otter population would take up to 3 years. Assuming a spill and contact to San Nicolas Island, the translocated sea otter population would probably be eliminated. Assuming a spill and contact to the Washington range, tens of otters would die, and recovery of the Washington sea otter population would possibly take more than 5 years.

CONCLUSION: Adoption of Alternative V (Part H) is expected to have lethal effects on sea otter populations in the Pacific Region as the result of accidental oil spills; population recoveries will take 4 to 5 years or more. Routine operations are not expected to impact the California or Washington sea otter populations.

(b) Nonendangered Species

1) Cetaceans

a) Killer Whale

The establishment of coastal buffers in the Alaska Region under this alternative (Part C-1) will result in a slightly lower number of wells drilled and the assumption of one less oil spill of 1,000 bbl or more in the Chukchi Sea. Given the low densities of killer whales in the areas affected (USDOI, MMS, 1987c), potential impacts to this species from routine activities under either version of Alternative V in the Alaska Region (Parts C-1 or Part C-2) are unlikely to decrease measurably from those discussed for Alternative I.

Killer whales are commonly sighted along the continental shelf and slope south of the Pribilof Islands (USDOI, MMS, 1985d). However, given the their relatively low population density in the southeastern Bering Sea, impacts to killer whales from routine activities and accidental events under Part D are not expected to change measurably from those described for Alternative I.

Due to the very small area proposed for deletion from consideration for future leasing under Part E, impacts to killer whales from routine activities and accidental events are not expected to change measurably from those described for Alternative I.

Given the low densities of killer whales in the area affected under Part F (USDOI, MMS, 1987a), impacts to this species from routine activities and accidental events are not expected to change measurably from those described for Alternative I.

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated.

The accidental events assumed to occur remain the same as in Alternative I, however, the probability of one or more spills of 1,000 bbl or greater occurring from production in the Pacific Region decreases to 28 percent. The overall impacts to the killer whale population from normal activities and accidental events under Alternative V (Part H) are not likely to differ substantially from Alternative I. Section IV.D.1.a(3) provides a discussion of potential impacts on the killer whale population and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on killer whales include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no measurable effects on the killer whale population.

In the Pacific Region, no mortality is expected as a result of accidental oil spills; changes in killer whale numbers and distribution in areas contacted by a spill are expected to last less than 1 year. In the Alaska Region, accidental oil spills are expected to result in the death of a few killer whales in protected waters. This level of mortality is expected to be undistinguishable from natural variability in the killer whale population.

CONCLUSION: Adoption of Alternative V is expected to result in killer whale mortality involving a few individuals. This level of mortality, is expected to be indistinguishable from natural variability in the killer whale population. Accidental oil spills in the Alaska Region are the primary impacting factor. There is an 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the alternative in the Alaska Region.

b) Harbor Porpoise

Given the low densities of harbor porpoises in the areas affected (USDOI, MMS, 1987a), potential impacts to this species from routine activities under either version of Alternative V in the Alaska Region (Parts C-1 or C-2) are unlikely to decrease measurably from those discussed for Alternative I. Section IV.D.1.a(3) provides a discussion of potential impacts on the harbor porpoise population and an analysis of the impacts expected as a result of Alternative I.

Given the low densities of harbor porpoises in the area affected under Part F (USDOI, MMS, 1987a), impacts to this species from routine activities and accidental events are not expected to change measurably from those described for Alternative I.

Due to the very small area proposed for deletion from consideration for future leasing under Part E, impacts to harbor porpoises from routine activities and accidental events are not expected to change measurably from those described for Alternative I.

Harbor seals are uncommon north of the Aleutians and generally restricted to shallow, nearshore waters (Leatherwood et al., 1982). Impacts to harbor porpoises from routine activities and accidental events under Part D are not expected to change measurably from those described for Alternative I.

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for the Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur in the Pacific Region remain the same as in Alternative I, however, the probability on one or more spills of 1,000 bbl or greater occurring from production in the Southern California Planning Area decreases to 28 percent.

The overall impacts to the harbor porpoise population from normal activities and accidental events under Alternative V (Part H) are not expected to differ substantially from Alternative I. Section IV.D.1.a(3) provides a discussion of potential impacts on the harbor porpoise population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on harbor porpoises include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Pipeline construction activities are expected to result in the displacement of harbor porpoises from a few square kilometers of nearshore habitat in Cook Inlet and the Gulf of Alaska for a period of several months.

It is likely that part of the harbor porpoise population in the Gulf of Alaska or Washington will be exposed to at least one of the large oil spills assumed to occur under this alternative. Assuming occurrence and contact, accidental oil spills are expected to result in the loss of a few harbor porpoises and the possible displacement of animals from the area of the spill for several months.

CONCLUSION: Adoption of Alternative V (Part H) is expected to result primarily in sublethal effects on harbor porpoises lasting less than 1 year. A few mortalities will result from accidental oil spills. No discernable changes in the species' abundance or distribution are expected.

2) Pinnipeds

a) Northern Elephant Seal

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline in the southern portion from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur remain the same as in Alternative I, however, the probability of one or more oil spills of 1,000 bbl or greater occurring from production decreases to 28 percent. Therefore, expected impacts to the northern elephant seal would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the northern elephant seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on elephant seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the northern elephant seal population.

If one of the two large tanker oil spills assumed to occur off southern California under this alternative were to contact the rookery beaches on San Miguel or San Nicolas Island during the species' winter breeding season, some pup mortality could occur. Assuming occurrence and contact, accidental oil spills are expected to result in the death of a few (less than 20) elephant seal pups. This level of mortality would not be distinguishable from natural variability within the elephant seal population.

CONCLUSION: Adoption of Alternative V (Part H) is expected to result primarily in sublethal effects on the northern elephant seal population. A few mortalities (less than 20) are expected to occur due to accidental oil spills. No discernable changes will occur in northern elephant seal abundance or distribution.

b) California Sea Lion

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur remain the same as in Alternative I, however, the probability of one or more spills of 1,000 bbl or greater occurring from production in the Southern California Planning Area decreases to 28 percent. Therefore, expected impacts to California sea lions would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts on the California sea lion population and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on California sea lions include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact the California sea lion population.

Two large tanker oil spills are assumed to occur off southern California under this alternative. A large oil spill contacting a California sea lion rookery during the species' summer breeding season would result in pup mortality. Assuming a spill during the summer and contact to one of the rookeries, it is possible that tens to hundreds of sea lion pups would die. Recovery of the California sea lion population from such a loss is expected to take 3 years or less.

CONCLUSION: Adoption of Alternative V (Part H) is expected to result primarily in sublethal effects on the California sea lion population. Some mortality (of tens to hundreds of pups) is expected to occur due to accidental oil spills. Population recovery will take no more than 3 years. No discernable changes in California sea lion distribution will occur.

(4) Atlantic Region

(a) Threatened or Endangered Species

1) Cetaceans

Potential impact-producing factors associated with routine gas and oil operations include noise, vessel and aircraft traffic, geophysical surveys, muds and cuttings discharges, and pipeline installation. Other than accidental collisions between tankers or support vessels and whales, routine potential impact-producing factors are considered sublethal. Although some activities are short-term, others have a duration of up to 30 years. Discussions of routine potential impact-producing factors are given in Sections IV.D.5.

Impacts under the Alternative V involve the accidental discharge of oil or other hydrocarbons. Over the estimated 30-year life of the Alternative V, the number of chronic operational discharges, spills of refined materials in quantities of less than 1 bbl to 50 bbl are assumed to be 20. One small spill (>50 bbl to <1,000 bbl) is also assumed. As in Alternative I, no oil spill greater than 1,000 bbl is assumed.

Special protections will insure the safeguarding of endangered and threatened cetaceans. Should specific concerns be identified, the Regional Director can invoke the biological stipulation to have the lessee undertake appropriate actions to determine the extent and the degree to which potential impact-producing factors may affect that resource. These actions can result in the modification of exploration and development activities.

Adoption of alternative V would defer 150 blocks, most of which are located in deep water at the shelf/slope margin offshore North Carolina. The largest portion encompasses 131 blocks located east of the Outer Banks, NC. Further south, and additional 19 blocks, in two groups of 7 and 12 blocks, respectively, located east and southeast of Cape Lookout, NC are also part of this alternative.

Alternative V would reduce to a small extent the level of OCS gas and oil activity in comparison with the scenario for Alternative I (Section IV.D.1.a(3)). The number of exploration/delineation and development/production wells are lowered to 32 and 97 wells, respectively. The number of pipelines (3) and landfalls (3) remains unchanged as does the number of supply bases (2), heliport facilities (2), and gas processing plants (2). Under this alternative, there will be a total of 5 offshore production platforms, 1 less that the number of platforms assumed for Alternative I. Other scenario parameters such as the scenario duration and the number of vessel and helicopter trips per platform or field per day are assumed to be identical to Alternative I.

The location of the blocks which would be excluded from leasing due to Alternative V include habitat utilized by endangered and threatened cetaceans. Small groups of wintering fin whales are likely to occur near or within the area which would be deferred under this alternative. The blocks located to the east of Cape Hatteras and Cape Lookout, NC, are year-round habitat for small groups of sperm whales and may be used as a wintering habitat by a portion of the Atlantic OCS fin whale population. In addition, deferral of the 131 blocks offshore the Outer Banks would exclude OCS gas and oil activity from an area of the mid-Atlantic OCS which appears to be an area of possible convergence of cetacean migratory pathways. Species occurring within this potential deferral area and the 19 blocks to the south at Cape Lookout, NC are discussed in detail in the MMS environmental report for exploratory drilling in this area (USDOI, MMS, 1990f) and in Section III.D.2.a in this document. Humpback, fin, and right whales tend to occur well inshore of the shelf edge north of Cape Hatteras and are not, therefore, expected to occur regularly in the vicinity of, or on, the remaining blocks in the northern portion of the mid-Atlantic OCS. Distribution of the sei whale is not certain for the area of the remaining blocks under Alternative V. Below this area, humpback whales are thought to depart the Atlantic OCS for deep-water migrations. Fin and sei whale distributions are uncertain and these whales may on occasion encounter OCS gas and oil activities in the south Atlantic. The known distribution of right whales south of North Carolina appears to be strictly coastal. Therefore, this species would unlikely be affected by routine offshore activities or accidents associated with gas and oil activities seaward of the 50-mile coastal buffer. Under Alternative V, the endangered cetacean species most likely to be contacted by OCS gas and oil activities would be the sperm whale.

Potential impact-producing factors associated with routine OCS gas and oil activities which could affect endangered cetacean populations are analyzed under Alternative I (see Section IV.D.1.a(3)). Under Alternative V, the level of impacts expected would be equal to or somewhat less than those expected for Alternative I, due to the similar but slightly lower levels of activity and infrastructure requirements and the location of the area excluded. Potential impact-producing factors associated with routine operations assumed to occur under Alternative V include underwater noise, muds and cuttings discharges, vessel and aircraft traffic, geophysical surveys, and pipeline construction. None of these impact factors are considered to be potentially lethal or debilitating to endangered cetaceans with the exception of accidental collisions between whales and support vessels.

Oil spills and discharges are likewise not expected to lethally impact individual endangered cetaceans or to result in measurably changes in population size, distribution, or behavior among these animals. The deferral of blocks within 82 km (50 mi) of shore would reduce slightly, but not measurably, the potential for migrating endangered baleen whales to contact routine or accidental gas and oil activities due to the specific location of the deferred blocks and habitat preferences of these species. Resident sperm whales would likely benefit to a slightly greater degree from Alternative V due to the shelf edge location of the blocks proposed for deferral. Were Alternative V to be adopted, such an action would reduce slightly the overall potential for impacts on endangered cetacean populations. However, adoption of Alternative V would not likely result in a measurable difference in impacts expected for Alternative I.

Even in the absence of special protections it is not expected that measurable impacts on endangered and threatened cetacean species would occur.

CONCLUSION: No measurable changes in the population size, distribution, or behavior of endangered and threatened cetacean populations would be expected under Alternative V.

2) Sirenians

The effects of potential impact-producing factors associated with routine gas and oil operations are generally restricted to those migratory individuals which may occur as far north as North Carolina during the warm months. These potential impact-producing factors include noises due to vessel and aircraft traffic, collisions with OCS gas and oil supply vessels, and possibly activities associated with pipeline construction. Other than accidental collisions between support vessels and manatees, the possible impact producing factors are short-term and sublethal.

Accidental impacts involve the discharge of oil or refined hydrocarbons. As these spills would most likely occur at support facilities or offshore, no measurable impacts on this species due to accidental discharges of hydrocarbons are expected.

Special protections will insure the safeguarding of the West Indian manatee. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriate actions to determine the extent of the population affected and the degree to which potential impact-producing factors may affect manatees. These actions may result in the modification of proposed exploration or development plans.

It is not expected that the level of activity associated with Alternative V would measurably affect the West Indian manatee due to this species' preference for coastal and riverine habitat, primarily within the state of Florida (see Section III.D.2). Adoption of Alternative V is not expected to reduce the potential for vessel and aircraft operating in nearshore or coastal waters to affect those few migratory individuals which travel as far north as North Carolina routinely during summer months. Adoption of Alternative V is also not likely to affect the potential for impacts on individuals of this species from accidents which may occur in inshore waters. Potential impacts which may affect individual animals but are not expected to measurably affect the species at the population level include startle reactions, vessel collisions and oiling (see Section IV.A). No impacts on the resident and non-migratory Florida manatee population are expected due to these animals' geographical location relative to the areas under consideration for lease in Alternative V. No change in the impact level given for Alternative I would be expected were these blocks to be deferred.

Even in the absence of special protections, it is not expected that measurable impacts on the West Indian manatee population would occur.

CONCLUSION: No impacts resulting in measurable changes in the population size, distribution, or behavior of the West Indian manatee are expected under Alternative V.

(b) Nonendangered Species

CETACEANS: Potential impact-producing factors associated with routine gas and oil operations which could affect nonendangered and nonthreatened cetaceans include noise, vessel and aircraft traffic, geophysical surveys, muds and cuttings discharges, and pipeline installation. For these smaller whales, routine potential impact-producing factors are considered sublethal. Although some activities are short-term, others have a duration of up to 30 years. Discussion of impact-producing factors and their effects are given in Sections IV.A.

Impacts on nonendangered cetaceans can result from the discharge of oil or other hydrocarbons. The number of chronic operational discharges and oil spills over the 30-year life have been described previously for Alternative V. An analysis of the potential impacts of contact between nonendangered and nonthreatened cetaceans and oil or other hydrocarbons is given in Sections IV.D.1.a(3).

Special protections will insure the safeguarding of nonendangered and nonthreatened cetaceans. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriate actions to determine the extent of the affected resource and the degree to which potential impact-producing factors may affect that resource. These actions may result in the modification of proposed exploration and development plans.

The blocks under consideration for lease under this alternative are identified in the preceding discussion of endangered and threatened cetaceans. The blocks excluded from consideration, in particular those off North Carolina, support a diverse community of mostly dolphin species. Deferral of these blocks may slightly reduce the potential for impacts due to both routine OCS gas and oil activities and accidents on these populations. Potential impact-producing factors such as underwater noise, muds and cuttings discharges, vessel and aircraft traffic, geophysical surveys, and pipeline construction activities would be eliminated on those blocks within the coastal buffers. However, accidental events such as chronic operational discharges and oil spills are still assumed to occur over the duration of the scenario. These potential impact-producing factors and their effects on nonendangered and nonthreatened cetaceans are described in Sections IV.D.1.a(3). The expected level of impact to nonendangered and nonthreatened cetacean populations from activities and events assumed for Alternative V are not expected to differ from the impacts identified for Alternative I. No measurable changes in the distribution, population size, or behavior of nonendangered and nonthreatened cetaceans due to routine gas and oil activities or oil spills on the Atlantic OCS are expected.

Even in the absence of special protections, it is not expected that measurable impacts on nonendangered and nonthreatened cetaceans would occur.

CONCLUSION: No measurable impacts on population size, distribution or behavior of nonendangered and nonthreatened cetaceans are expected under Alternative V.

d. Impacts on Terrestrial Mammals

(1) Gulf of Mexico Region

ALABAMA, CHOCTAWHATCHEE, AND PERDIDO KEY BEACH MICE: Accidental events such as oil spills and oil spill response activities may adversely affect Alabama, Choctawhatchee, and Perdido Key beach mice. Four oil spills (greater than or equal to 1,000 bbl) from program-related activities and increased import tankering due to decreased domestic production have been described previously. It is expected that oil spills of any size class resulting from Alternative V will not contact or affect Alabama, Choctawhatchee, and Perdido Key beach mice or their habitat due to their limited home range.

CONCLUSION: As a result of the adoption of Alternative V, no adverse effects are expected to occur to the Alabama, Choctawhatchee, and Perdido Key beach mice nor their habitats.

(2) Alaska Region

CARIBOU: Disturbance of caribou caused by activities in support of offshore operations, as well as oil-spill toxicity, is not expected to decrease in coastal areas adjacent to the Chukchi Sea and Hope Basin Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I.

Moving industrial activities farther offshore in the Chukchi Sea and Hope Basin is not expected to reduce disturbance of caribou from such activities adjacent to the deferred coastal area. Activities disturbing to caribou (e.g., helicopter traffic) still are expected to occur in the vicinity of caribou coastal use areas, thereby diminishing any reduction in disturbance occurring elsewhere. The overall disturbance impact resulting from this alternative is expected to be approximately the same as Alternative I, requiring one generation or more for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Chukchi Sea and Hope Basin is expected to reduce to a minimal extent the toxic effects of spilled oil by allowing more extensive weathering before shore contact.

Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be reduced only slightly from Alternative I, because caribou rarely would be exposed to or consume oil, requiring less than one generation for recovery.

CONCLUSION: Overall disturbance of caribou resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring one generation or more for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring less than one generation for recovery. There is an 18 to 57 percent probability of one or more spill of 10,000 bbl or greater occurring throughout the 24- to 32-year life of the alternative in the Alaska Region.

e. Impacts on Marine and Coastal Birds

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect endangered and threatened birds. It is expected that OCS offshore flights will not disturb endangered and threatened birds because of guidelines by the MMS and adherence to the FAA recommended minimum ceilings. It is expected that vessel traffic will not disturb endangered and threatened birds because it occurs in/out of existing port areas greater than one-half mile from critical habitats. It is expected that construction of pipeyards and terminals will not disturb or displace endangered and threatened birds because they will not be constructed in critical habitat within upland or wetland areas.

Accidental events such as oil spills and loss of trash and debris may adversely affect endangered and threatened birds. Four oil spills greater than or equal to 1,000 bbl from program-related activities and increased import tankering due to decreased domestic production have been described previously. The effect on endangered and threatened birds from oil spills is expected to be primarily sublethal and less than one generation in duration with fewer than five mortalities of the brown pelican and piping plover. All deaths of endangered and threatened birds affected by spilled oil will be replaced through natural recruitment from the next generation. It is assumed that the combination of lessees obeying special MMS prohibitions and enactment of MARPOL, Annex 5, greatly reduces if not eliminates future OCS-related loss of trash and debris. The effect on endangered and threatened birds from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 birds.

CONCLUSION: As a result of this alternative, there will be no discernible decline in an endangered or threatened bird population or species, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Nonendangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect marine and coastal birds. OCS offshore helicopter flights will not disturb marine and coastal birds because of guidelines by the MMS and adherence to the FAA recommended minimum ceilings. Vessel traffic will not disturb marine and coastal birds because it occurs in/out of existing port areas. The new pipeline landfalls and piping through coastal areas are estimated to affect 27 ha of marine and coastal bird habitat. It is assumed that construction of pipeyards and terminals will not disturb or displace marine and coastal birds because they will be constructed in upland areas and not in wetlands. It is expected that pipeline landfalls will disturb and/or displace marine and coastal birds within/from 27 ha of coastal area.

Accidental events such as oil spills and loss of trash and debris may adversely affect marine and coastal birds. Four oil spills greater than or equal to 1,000 bbl from program-related activities and increased import tankering due to decreased domestic production have been previously described. Less than five small spills will contact the Gulf coastline. It is estimated that an oil spill greater than 1,000 bbl will contact and affect 50 km of beach, 25 km of inshore shoreline, and 16 ha of wetlands. It is estimated that small oil spills will contact and affect 100 ha of estuaries. Lethal effects are expected for no more than 100 birds from direct oiling. Sublethal effects are expected for no more than 1,000 birds from contact with oil and contamination of food sources.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a marine or coastal bird population or species, and no change in distribution or abundance. Any affected individuals, by death or sublethal effects, will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Alaska Region

(a) Threatened or Endangered Species

1) Arctic and American Peregrine Falcons

Because the scenario for Alternative V is the same as Alternative I in areas within the range of arctic and American peregrine falcons, effects on these species due to Alternative V would be as discussed for Alternative I.

CONCLUSION: Based on the scenario for Alternative V, noise is estimated to cause abandonment of up to 50 percent of the peregrine falcon-nest sites, some nestling mortality, and cause a reduced rate (up to 50%) of reproduction. Assuming that one or more of the assumed spills contacts feeding areas for peregrine falcons, the spills would indirectly affect up to 50 percent of the peregrine falcon population in Alaska and could result in up to 50 percent mortality. This decline in species numbers would last longer than 5 years. There is a 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the peregrine falcon over the 30-year life of the alternative.

2) Short-Tailed Albatross

Effects on the short-tailed albatross associated with Alternative V could result from noise disturbance, entanglement in debris, or consumption of plastics affecting about 2 percent of the albatross population each year. The majority of these effects would be sublethal.

Short-tailed albatross feed on the surface and will sometimes follow vessels to feed on discarded materials. This behavior could bring them in contact with oil from an oil spill. However, the short-tailed albatross is an infrequent visitor to the Alaskan OCS and is scattered over much of the North Pacific Ocean and the Bering Sea. It is estimated that the oil spills assumed as a result of Alternative V would have lethal effects on between 1 and 25 percent of the population, depending on the number of birds feeding in the area. The decline in species numbers would last longer than 5 years.

CONCLUSION: Based on the scenario for Alternative V, disturbance, entanglement in debris, and consumption of plastics is not expected to affect more than about 2 percent of the short-tailed albatross population. The majority of these effects would be sublethal. Oil spills associated with Alternative V could lethally affect between 1 and 25 percent of the population, depending on the number of birds feeding in the area. The probability of an oil spill of 10,000 bbl or greater occurring in the range of the short-tailed albatross ranges up to a 57 percent.

(b) Nonendangered Species

1) Bald Eagle (Alaska Population)

Potentially disturbing activities associated with construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, are expected to decrease in the coastal area adjacent to the Gulf of Alaska (Yakutat) Planning Area considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zone, than is assumed for Alternative I. Deferral of coastal areas adjacent to the Chukchi Sea, Hope Basin, Norton Basin, and St. George Basin is not expected to result in decreased disturbance in those areas, because eagles rarely occur there.

Moving industrial activities farther offshore in the Yakutat area is expected to minimally decrease disturbance from activity in this area because relatively few eagles are likely to be affected. The overall disturbance impact resulting from this alternative is expected to be approximately the same as Alternative I, requiring no more than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Yakutat area is expected to reduce somewhat the toxic effects of spilled oil by allowing more extensive weathering to occur before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be approximately the same as Alternative I, requiring three or more generations for recovery.

CONCLUSION: Overall disturbance of bald eagles resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring no more than one generation for recovery to the original population status. Impacts caused by oil spills are expected to be the same as Alternative I, requiring three or more generations for recovery. There is an 18 to 34 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the bald eagle over the 24- to 32-year life of the alternative.

2) Waterfowl

DIVING DUCKS: Disturbance of diving ducks caused by construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, is expected to decrease in coastal areas adjacent to the Chukchi Sea, Hope Basin, and Norton Basin Planning Areas considered for leasing under this alternative (less so in the St. George Basin and Gulf of Alaska) by restricting the location of industrial sites to areas farther offshore than is assumed for Alternative I.

Moving industrial activities farther offshore in the above areas is expected to reduce somewhat the disturbance of diving ducks, particularly those nesting on barrier islands, from such activities in the deferred coastal areas. However, activities disturbing to ducks (e.g., helicopter traffic) still may occur in the vicinity of nesting, molting, or migration concentrations, thereby diminishing the overall reduction in disturbance occurring elsewhere. In addition, this alternative could cause the area disturbed by air traffic to expand, because support aircraft would be required to fly longer distances to more sites located farther offshore than under Alternative I. Deferral of blocks in the Yakutat area is expected to decrease disturbance slightly, if at all, from activity in this area due to the small numbers of ducks likely to be affected. The overall disturbance impacts resulting from this alternative are expected to be approximately the same as Alternative I, requiring no more than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the areas identified above is expected to reduce somewhat the toxic effects of spilled oil by allowing more extensive weathering before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. The overall losses caused by oil spills are expected to be reduced somewhat from Alternative I, but still would require one or more generations for recovery.

CONCLUSION: Overall disturbance of diving ducks resulting from this alternative is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring no more than one generation for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring one or more generations for recovery. There is an 18 to 57 percent probability of one or more spills or 10,000 bbl or greater occurring throughout the range of the diving ducks over the 24- to 32-year life of the alternative.

GEESE: Disturbance of geese caused by construction and/or operation and vessel support of offshore drillships and platforms, as well as oil-spill toxicity, may decrease in coastal areas adjacent to the Chukchi Sea, Hope Basin, and Norton Basin Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I. Deferral of buffers in the St. George Basin and Gulf of Alaska are expected to result in minimal impact reduction.

Moving industrial activities farther offshore in the Chukchi Sea, Hope Basin, and Norton Basin is expected to reduce somewhat the disturbance of geese, particularly those nesting on barrier islands, from such activities in the deferred coastal area. However, activities disturbing to geese (e.g., helicopter traffic) still may occur in the vicinity of nesting, molting, or migration concentrations, thereby diminishing any overall reduction in disturbance occurring elsewhere. Also, this alternative could cause the area disturbed by air traffic to expand because support aircraft would be required to fly longer distances to more sites located farther offshore than under Alternative I. Deferral of blocks in the Pribilof and Yakutat areas is expected to decrease disturbance slightly if at all from activity in this area due to the small numbers of geese likely to be affected. Overall disturbance impact resulting from this alternative are expected to be approximately the same as Alternative I, requiring no more than one generation for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the Chukchi Sea, Hope Basin, and Norton Basin areas is expected to reduce somewhat the toxic effects of spilled oil by allowing more extensive weathering to occur before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall impacts caused by oil spills are expected to be reduced somewhat from Alternative I, but still would require one generation or less for recovery of most species and more than one for emperor, cackling and dusky Canada, and tule white-fronted geese.

CONCLUSION: Overall disturbance of geese resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring no more than one generation for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring no more than one generation for recovery of most species and more than one for emperor, cackling and dusky Canada, and tule white-fronted geese. There is an 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the geese over the 24- to 32-year life of the alternative.

(3) Pacific Region

(a) Threatened or Endangered Species

1) Bald Eagle (Pacific Population)

Under Alternative V (Part H) there would be one less platform and one less pipeline in the Pacific Region resulting in a slight decrease in the level of routine activities. As in Alternative I, however, no onshore facilities or pipeline landfalls are assumed for Alternative V. The level of helicopter traffic would decrease slightly because of the reduction in platforms.

Disturbances to bald eagles may arise from those activities that can occur in close proximity to the shoreline, mainly air traffic. Given the extremely rare occurrence of bald eagles along the southern California coast, impacts to this species from routine activities under Alternative V are not expected.

The oil spill assumptions for the Pacific Region, including Alaskan tanker spills, do not change under Alternative V, and the impact of accidental oil spills on bald eagles is expected to be the same as Alternative I (Section IV.D.1.a(5)). Due to the extreme rarity of this species along the southern California coast, the accidental pipeline or Alaskan tanker oil spills assumed for this alternative are not expected to impact this species. However, as in Alternative I, the Alaskan tanker spill assumed to occur off the Washington coast is expected to result in the deaths of possibly tens of eagles. Because of the relatively slow population growth rates of bald eagles, recovery in this area could take up to 4 years.

CONCLUSION: Under Alternative V, routine activities are not expected to have an impact on bald eagles in the Pacific Region. Accidental oil spills assumed for this alternative are expected to result in the deaths of tens of eagles along the Washington coast from an Alaskan tanker spill, with recovery taking up to four years.

2) California Least Tern

Disturbances to least terns may arise from activities assumed for the Pacific Region under Alternative V that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on least terns (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from this proposal within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Under Alternative V (Part H) there would be one less platform and one less pipeline in the Pacific Region resulting in a slight decrease in the level of routine activities. As in Alternative I, however, no new pipeline landfalls, heliports, or other onshore facilities are assumed for Alternative V, and therefore, impacts on least terns from routine activities are not expected.

The oil spill assumptions for the Pacific Region, including Alaskan tanker spills, do not change under Alternative V, and the impact of accidental oil spills on least terns is expected to be the same as Alternative I (Section IV.D.1.a(5)). As outlined in Alternative I, if an oil spill occurred from May to September and was in the vicinity of a tern colony, as many as 50 pairs or about 3 percent of the population could be affected. Recovery from the loss of more than a few individuals is expected to take 2-4 years, depending on how severely a colony is affected.

CONCLUSION: Routine OCS-related activities associated with Alternative V in the Pacific Region are not expected to have an impact on least terns. The principle impacting agent under Alternative V is oil from an accidental pipeline spill and/or an Alaskan tanker spill. Expected outcomes of spill contact with a tern colony are loss of up to 50 pairs (3 percent of the population) and disruption of the colony's reproductive cycle for that year. Recovery is expected to take 2-4 years.

3) California Brown Pelican

Disturbances to California brown pelicans may arise from several activities assumed for the Pacific Region under Alternative V, including vessel and air traffic, platform and pipeline construction, and platform removal. Other activities are either not expected to have an effect on California brown pelicans (geophysical surveys and platform discharges) or are not projected to occur within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Under Alternative V (Part H) there would be one less platform and one less pipeline in the Pacific Region resulting in a slight decrease in the level of routine activities. Impacts are expected to be generally the same as Alternative I (Section IV.D.1.a.(5)), although slightly lower. The effect of routine activities on brown pelicans is expected to be limited to the temporary displacement (i.e., a few days) of a few individuals resting or foraging near platform/pipeline construction sites.

The oil spill assumptions for the Pacific Region, including Alaskan tanker spills, do not change under Alternative V, and the impact of accidental oil spills on pelicans is expected to be the same as Alternative I. Oil spills assumed for southern California could result in the oiling of 50 to as many as 1,000 adult pelicans, with mortality ranging from 20-50 percent of birds contacted. If a spill occurred during the breeding season and contacted a pelican nesting area, major disruptions in reproduction could be expected, with the potential loss of up to 25 percent of active nests. Recovery could be expected within 1 to 4 years.

CONCLUSION: The effect of routine OCS-related oil and gas activities assumed under Alternative V (Part H) in the Pacific Region is expected to be limited to the temporary displacement (e.g., a few days) of a few individuals resting or foraging near platform/pipeline construction sites. The principle impacting agent in the Pacific Region is oil from an accidental pipeline spill and/or a tanker spill. From 50 to 1,000 pelicans are expected to be oiled, with mortality occurring in 20 to 50 percent of those contacted; recovery is expected in 1 to 4 years.

4) Light-Footed Clapper Rail

Disturbances to light-footed clapper rails may arise from those activities assumed for the Pacific Region under Alternative V that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on light-footed clapper rails (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from this proposal within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Under Alternative V (Part H) there would be one less platform and one less pipeline in the Pacific Region resulting in a slight decrease in the level of routine activities. As in Alternative I, however, no new pipeline landfalls, heliports, or other onshore facilities are assumed for Alternative V, and therefore, impacts on clapper rails from routine activities are not expected.

The oil spill assumptions for the Pacific Region, including Alaskan tanker spills, do not change under Alternative V, and the impact of accidental oil spills on least terns is expected to be the same as Alternative I (Section IV.D.1.a(5)). As discussed in Alternative I, light-footed clapper rails seasonally breed in about 14 widely-spaced marshes from Santa Barbara to the Mexican border (USDOI, FWS, 1980b), and an oil spill would have to contact the birds at one of these sites. This is considered unlikely, however, as protective equipment (e.g., oil booms) is readily available throughout the rail's range, and oil can generally be prevented from entering estuaries and marshes. Nevertheless, if an oil spill should occur and contact a rail marsh, some mortality is expected. Depending on various factors (spill date, spill size, weather, distance from shore), the impact on light-footed clapper rails could range from a few individuals to the loss of this species from an entire marsh. Due to the continued depressed population of this species, the loss of more than a few individuals could be significant, requiring from 2 to as much as 6 or 7 years to recover.

CONCLUSION: Routine activities and accidental oil spills assumed to occur as a result of Alternative V are not expected to have an impact on light-footed clapper rails.

(b) Nonendangered Species

1) Seabirds

Disturbance of seabirds caused by construction and/or operation and vessel support of offshore drillships and platforms, as well as oil spill toxicity, is expected to decrease in coastal areas adjacent to the Chukchi Sea, Hope Basin, Norton Basin, St. George Basin, and Gulf of Alaska Planning Areas considered for leasing under this alternative by restricting the location of industrial sites to areas farther offshore, beyond the proposed buffer zones, than is assumed for Alternative I.

Moving industrial activities farther offshore in the areas identified above is expected to reduce somewhat the disturbance of seabirds, particularly those nesting on barrier islands, from such activities in the deferred coastal area. However, activities disturbing to birds (e.g., helicopter traffic) still may occur in the vicinity of colonies or foraging concentrations, thereby diminishing the overall reduction in disturbance occurring elsewhere. In addition, this alternative could cause the area disturbed by air traffic to expand because support aircraft would be required to fly longer distances to more sites located farther offshore than under Alternative I. Deferral of blocks in the Yakutat area is expected to decrease disturbance slightly if at all from activity in this area due to the small numbers of seabirds likely to be affected. Overall disturbance impacts resulting from this alternative are expected to be approximately the same as Alternative I, requiring one generation or less for recovery to the original population status. Altering the total number of blocks included in the deferred area is not expected to change the overall impact from disturbance.

Moving potential oil-spill sites farther offshore beyond the proposed buffers in the above areas (Yakutat to a minimal extent) is expected to reduce somewhat the toxic effects of spilled oil by allowing more extensive weathering before shore contact. Impacts from oil spills elsewhere in the Alaska Region are not expected to differ from Alternative I. Overall losses caused by oil spills are expected to be reduced somewhat from Alternative I but still would require several generations for recovery.

CONCLUSION: Overall disturbance of seabirds resulting from Alternative V is not expected to be sufficiently different from Alternative I to alter the conclusion of requiring one generation or less for recovery to the original population status. Impacts caused by oil spills are expected to be about the same as Alternative I, requiring several generations for recovery. There is an 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 24- to 32-year life of the alternative in the Alaska Region. There is up to an 81-percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the western coast of the United States over the 24- to 32-year life of the alternative.

2) Shorebirds

Disturbances to shorebirds may arise from those activities that can occur in close proximity to the shoreline, mainly air traffic, pipeline construction, and onshore support-facility construction and operations. Other activities (geophysical surveys, platform construction, platform discharges, and platform removal) are not expected to have an effect on shorebirds. Routine activities are not expected to change under Alternative V (Parts B to F) in the Alaska Region, and impacts in that region are expected to be the same as Alternative I (Section IV.D.1.a(5)). Air traffic in the Alaska Region is expected to cause disruptions in reproduction of local (i.e., within 0.5 km of flight paths) shorebird populations, with recovery expected within 1 year. Pipeline landfalls are expected to cause the displacement of shorebirds from the area immediately adjacent to the construction (within a few hundred meters) for about 6-8 weeks. Construction of onshore facilities could result in displacement of shorebirds within about 0.5 km of construction and the loss of about 10-15 hectares of habitat from each planning area. A temporary (i.e., less than 1 year) reduction in local productivity may result if nesting habitat were lost to construction. Because of the widespread distribution of most shorebird species in Alaska and the very small amount of habitat potentially affected, however, construction activities are not expected to cause a long-term (i.e. 1 year), measurable impact to shorebird populations.

Under Alternative V (Part H) there would be one less platform and one less pipeline in the Pacific Region resulting in a slight decrease in the level of routine activities. As in Alternative I, however, no onshore facilities or pipeline landfalls are assumed for Alternative V. The level of helicopter traffic would decrease slightly because of the reduction in platforms, but overall impacts on shorebirds are expected to be generally the same as under Alternative I. Helicopter traffic is expected to result in temporary (i.e., a few weeks) disruptions in shorebird foraging or resting behavior in the vicinity (0.5 km) of flight paths.

Most of the coastal buffers proposed for the Alaska Region under Alternative V will not cause a change in oil spill assumptions, and impacts of oil spills on shorebirds are expected to be the same as Alternative I (mortality ranging from less than 100 to a few thousand shorebirds, with recovery in 1-3 years). However, under Part C-1, the number of oil spills assumed for the Chukchi Sea would be reduced from 3 to 2, and the overall risk to shorebirds would be accordingly lower in that area.

The oil spill assumptions for the Pacific Region, including Alaskan tanker spills, do not change under Alternative V, and the impact of accidental oil spills on shorebirds is expected to be the same as Alternative I (loss of a few to about 500 birds from southern California and Washington, with recovery within 1 year).

CONCLUSION: Under Alternative V, impacts from air traffic in the Alaska Region are expected to include disturbance of local (i.e., within 0.5 km of flight paths) shorebird populations with some local reductions in productivity, and recovery occurring within 1 year. Construction activities assumed for the Alaska Region are not expected to cause a measurable impact on shorebird populations, although a temporary (i.e., year) reduction in productivity within 0.5 km of construction is expected. Impacts on shorebirds from routine OCS-related activities assumed for the Pacific Region are expected to be limited to temporary (i.e., a few weeks) disruptions in the foraging or resting behavior of those shorebirds in the immediate vicinity (i.e., within 0.5 km) of helicopter flight paths.

The principle impacting agent from the proposed action in both the Alaska and Pacific Regions is oil from accidental spills. The impact of assumed oil spills on shorebirds is expected to range from less than 100 to a few thousand fatalities, with recovery in 1-3 years in the Alaska Region, and from a few to as many as 500 fatalities, with recovery occurring in 1-2 years in the Pacific Region.

(4) Atlantic Region

(a) Threatened or Endangered Species

Potential impact-producing factors associated with routine OCS gas and oil operations which could affect endangered and threatened marine birds include noise, aircraft and vessel traffic, muds and cuttings discharges, and possibly pipeline construction. These and additional, but tentative, sources of impacts, including the presence of offshore structures and artificial lighting, are discussed in detail in Section IV.D.1.a(5). Routine activities are not likely to produce lethal impacts on affected individuals.

Accidental impacts involve the discharge of oil or other hydrocarbons. Over the timeframe of the scenario for Alternative V, the number of chronic operational discharges, spills of refined materials in quantities of more than 1 bbl to 50 bbl are assumed to be 20. One small spill (>50 bbl to <1,000 bbl) is also assumed. As in Alternative I, no oil spill greater than 1,000 bbl is assumed.

Special protections will be in place if Alternative V is adopted to insure that these resources are safeguarded. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriated actions to determine the extent and the degree to which potential impact-producing factors may affect the resource. These actions may result in the modification of activities connected exploration and development plans.

The major differences between Alternative V and Alternative I have been described previously.

The exclusion of the blocks considered for lease in Alternative I, would not reduce the potential impacts to endangered bald eagles or threatened piping plovers due to the terrestrial and shoreline habitat preferences of these species. However, there are three endangered bird species which do occur within potential deferral area (the roseate tern, peregrine falcon, and Bermuda petrel).

Both the roseate tern and peregrine falcon are migratory transients and occur only briefly on a seasonal basis on the mid- and south Atlantic OCS (see Section III.C.2.b.1). Neither the roseate tern or the peregrine falcon are considered particularly vulnerable to routine OCS gas and oil activities and their associated impact-producing factors, or even accidental discharges of hydrocarbons. Based on these species' limited occurrence, distribution, behavior, relationship to the area considered for lease and the expected impact levels expressed for the various individual impact-producing factors discussed under Alternative I, no measurably change in impact level would be expected under Alternative V.

The Bermuda petrel has only been reported on Atlantic OCS waters within the area offshore North Carolina east of Cape Hatteras (see Section III.D.2). The seasonal occurrence of this species, or even whether this species is a regular offshore inhabitant, is uncertain. Although the area where this endangered bird has been reported is also the location of the coastal buffer, no expected change in impact levels from that stated in Alternative I would be expected for this species under Alternative V.

Even in the absence of special protections, no measurable impacts on endangered and threatened bird species are expected to occur.

CONCLUSION: No measurable changes in population size, distribution, or behavior is expected to occur among endangered and threatened birds on the Atlantic OCS under Alternative V.

(b) Nonendangered Species

For a description of the Alternative V scenario including such factors as infrastructure, routine and accidental events, scenario duration and other factors, see the preceding discussion of endangered and threatened birds.

Potential impact-producing factors associated with routine OCS gas and oil operations which could affect nonendangered and nonthreatened marine birds include noise, aircraft and vessel traffic, muds and cuttings discharges, and possibly pipeline construction. These and additional, but tentative, sources of impacts including the presence of offshore structures and artificial lighting are analyzed in detail in Section IV.D.1.a(5). Based on this analysis, no assumed routine impact-producing factor (e.g., noise, vessel or aircraft traffic, discharge of drill muds or pipeline construction) is expected to be fatal to species of nonendangered and nonthreatened birds.

Special protections will insure that nonendangered and nonthreatened birds are safeguarded. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriated actions to determine the extent and the degree to which potential impact-producing factors may affect the resource. These actions may result in the modification of activities associated with exploration and development plans.

The proposed 82 km (50 mi) coastal buffer area, the area supports moderate to substantial seasonally resident and migratory populations of coastal and pelagic seabirds. The adjacent coastal waters, estuaries, and barrier island habitat support a diverse assemblage shorebirds, wading birds, and waterfowl. Seasonally, certain species may be quite abundant in this area. However, it is unlikely that Alternative V would result in a measurable reduction of impacts on nonendangered and nonthreatened birds from routine OCS gas and oil operations in comparison with the impacts expected under Alternative I.

The blocks which are located offshore Cape Hatteras and Cape Lookout, due to their geological and oceanographic character, represent Atlantic OCS pelagic seabird habitat of varied importance depending on the particular species considered. The species diversity among pelagic seabirds occurring on and adjacent to these blocks is well documented (see Sections III.D.2; IV.D.1.a(5); and USDOI, MMS, 1990f). Deferral of these offshore blocks may confer some slight measure of protection to species considered to be of special concern by the adjoining coastal state. For example, the black-capped petrel is identified as a species of special concern by North Carolina since a significant portion of the population appears to forage in this area during certain months of the year (Lee and Socci, 1989). Other pelagic seabirds identified as species of concern by North Carolina for various reasons include the common loon, greater shearwater, sooty shearwater, band-rumped storm-petrel, bridled tern, and northern gannet (Lee and Socci, 1989). Although some slight degree of protection from impacts due to routine OCS gas and oil activities may be derived for these species under Alternative V, it is not expected that this would result in different impacts than those expected under Alternative I.

Chronic operational discharges are assumed to occur intermittently during the 30-year life of the Alternative V. The majority of the these discharges and the single small oil spill (>50 and < 1,000 bbl) is assumed to occur offshore. For reasons given in Sections IV.D.1.a(5), it is not possible to predict the number of birds which may be impacted sublethally or lethally by spilled hydrocarbons. If Alternative V were adopted, impacts on coastal seabirds, shorebirds, waterfowl and wading species would not be expected to differ from the impacts analyzed under Alternative I. It is unlikely that chronic operational discharges would measurably affect these species. Likewise, a single small spill occurring offshore is not expected to impact shorewater and coastal species. However, pelagic species of concern to a particular State and occurring within the shelf/slope blocks excluded in the coastal buffer, may derive some benefit from adopting this alternative. However, as most of these species are considered to be relatively invulnerable to oiling impacts (see Section IV.D.1.a(5)), this alternative is not be expected to change the impact level for these particular species or for Atlantic OCS populations of nonendangered and nonthreatened birds.

Even in the absence of special protections, it is unlikely that measurable impacts on nonendangered and nonthreatened bird species would occur.

CONCLUSION: Adoption of Alternative V is not expected to result in measurable changes in population size, distribution, or behavior of nonendangered and nonthreatened birds on the Atlantic OCS.

f. Impacts on Fish Resources

(1) Gulf of Mexico Region

(a) Gulf Sturgeon

Accidental events such as oil spills may adversely affect Gulf sturgeon. Four oil spills greater than or equal to 1,000 bbl from program-related activities and increased import tankering due to decreased domestic production have been described previously. Considering the locations of oil pipelines and platforms offshore, and the pattern of coastal ocean currents, it is assumed that such a spill (25,000 bbl pipeline spill) would contact the eastern Texas/western Louisiana coast. This spill will contact and affect 16 ha of estuaries. It is assumed that an oil spills of 1,000 bbl or more will not contact Gulf sturgeon due to their limited home range. Numerous small spills are assumed to occur and disperse rapidly along a stretch of coast extending from western Mississippi to eastern Texas. Less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. The small oil spills are assumed to contact and affect 100 ha of estuaries. Only sublethal effects on Gulf sturgeon are expected from contact with small oil spills.

CONCLUSION: As a result of this alternative, the effect on Gulf sturgeon is expected to be undetectable and recovery from any sublethal effects will require less than one year.

(b) Other Fish Resources

A number of routine events such as operational discharges, structure removals, and seismic surveys may adversely affect fish resources. It is assumed that offshore discharges of drilling muds and produced waters will rapidly dilute to background levels and not affect fish resources. Lethal effects to demersal species resulting from explosive platform removals would occur up to 50 m from the detonation site and sublethal effects to fish with internal air chambers extend to 150 m. It is assumed that only airguns will be used in seismic surveys as a result of Alternative V and not affect fish resources.

Accidental events such as oil spills and subsurface blowouts may adversely affect fish resources. Four oil spills greater than or equal to 1,000 bbl from program-related activities. It is assumed that some spilled oil will penetrate into estuaries. An oil spill of 1,000 bbl or more is assumed to contact and affect 16 ha of estuaries; whereas, the smaller oil spills are assumed to contact and affect 100 ha of estuaries. Both lethal and sublethal effects on fish resources are expected from oil spills. It is assumed that several subsurface blowouts will occur and that blowouts are expected to cause lethal effects on fish resources within 50 m and sublethal effects within 150 m of the blowout site.

CONCLUSION: As a result of this alternative, the effect on fish resources is expected to be undetectable to estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters, to pelagic species such mackerels, cobia, bluefish, amberjack, and dolphin fish, and to reef fish species such as grouper, snapper, gag, scamp, and seabass. Any loss of fish resources will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil, and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Alaska Region

(a) Pacific Salmon (Alaska Population)

Routine activities and accidental events are assumed to occur at the same levels for Alternative V as for Alternative I in the Alaska Region. Impacts on Pacific salmon would be the same as Alternative I. Section IV.D.1.a(6) described the potential impacts on salmon populations.

CONCLUSION: Routine activities assumed for Alternative V are expected to have no measurable effect on salmon. Oil spills contacting migratory salmon populations are expected to have adverse impacts on small segments of these fish. The numbers so affected would be small in proportion to the total; and any oil spill would have only a small-scale, small-area, and short-time effect. There is an 18 to 34 percent chance of one or more spills of 10,000 bbl or greater occurring throughout the pelagic range of migratory salmon over the 24- to 32-year life of the alternative.

(b) Walleye Pollock

Because the scenario for Alternative V is the same as Alternative I in areas within the range of walleye pollock, effects on these species as the result of f Alternative V would be as discussed for Alternative I.

CONCLUSION: The level of oil and gas exploration/development for Alternative V is not expected to have a measurable effect on walleye pollock.

(c) Arctic Cisco

Alternative V reduces the intensity at which oil and gas exploration and development would occur with subsequent decreased impact on the limited fish resources of the arctic area. Beaufort Sea arctic cisco populations are quite variable in number with no measurable effects from commercial harvest or development impacts identified to date. Predictions, however, are for an impending decline during the early 1990's with subsequent marked increases (Gallaway et al., 1989). The species always may have shown this variation in population numbers with no known environmental causes.

Drilling discharges and offshore construction (platforms and pipelines) would be the same as for Alternative I. The arctic cisco, a major pelagic finfish of the Beaufort sea, but absent from the Chukchi Sea, would not be measurably affected from these routine activities.

CONCLUSION: Based on the assumptions for Alternative V, no measurable effects are expected for arctic cisco in the Alaska Region.

(d) Other Fish Resources

FINFISH: Routine activities and accidental events are assumed to occur at the same levels for Alternative V as for Alternative I in the Alaska Region. Impacts on other fish resources would be the same as Alternative I. Section IV.D.1.a(6) described the potential impacts on finfish populations. Because the scenario for Alternative V is the same as Alternative I , effects on these species as the result of Alternative V would be as discussed for Alternative I.

CONCLUSION: Based on the assumptions for Alternative V, no appreciable adverse effects are anticipated on either the finfish populations in the Alaska Region.

SHELLFISH: Routine activities and accidental events are assumed to occur at the same levels for Alternative V as for Alternative I in the Alaska Region. Impacts on shellfish would be the same as Alternative II Section IV.D.1.a(6) described the potential impacts on shellfish populations. Because the scenario for Alternative V is the same as Alternative I, effects on shellfish as the result of Alternative V would be as discussed for Alternative I.

CONCLUSION: Based on the assumptions for Alternative V, no appreciable adverse effects are anticipated on shellfish populations in the Alaska Region.

(3) Pacific Region

(a) Pacific Salmon (Pacific Population)

Impacts on Pacific OCS Region fishery resources from both normal development and accidental causes will be the same as those described for Alternative I discussed in Section IV.D.1.a(6), except in the buffer area. Routine operations will not occur in the buffer area. Therefore, impacts associated with those activities will be eliminated. Routine activities and associated impacts which would be eliminated in the buffer area include installation and operation of manmade structures, effluents and discharges from drilling discharges, and underwater noise from geophysical surveys.

The hypothesized level of development for Alternative V is reduced from Alternative I by one platform and an associated pipeline. The probability of one or more oil spill from greater than 1,000 bbl occurring from production in the Southern California Planning Area is 28 percent. It is also assumed not to occur in the buffer area (Figure II.E.1-9). Although oil spilled from a pipeline could move into the buffer area and contact salmon populations within it, the likelihood is reduced.

Tanker traffic is unaffected by this alternative, and as a result, salmon habitat throughout the planning area is at risk from a tanker spill. A tanker oil spill entering a spawning stream in could cause mortalities to hundreds of salmons in the stream affecting the impacted year class for two to four years. However, regional impacts from that spill would not be discernible from natural variations of populations within the area. Overall, the large oil spills estimated for Alternative V are expected to result in some lethal (less than 10%), or sublethal effects that would not be discernible from natural variations of salmon populations.

CONCLUSION: Adoption of Alternative V would eliminate impacts from routine operations in the buffer area. Routine activities would result in changes in the distribution of some migrating populations for a period of minutes to hours with no discernable change from natural variations of salmon populations. A tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of salmons in that stream affecting the impacted year class for 2 to 4 years. However, regional impacts would not be discernible from natural variations of populations within the area.

(b) Steelhead Trout

Impacts on Pacific OCS Region fishery resources from both normal development and accidental causes will be the same as those described for Alternative I discussed in Section IV.D.1.a(6), except in the buffer area. Routine operations will not occur in the buffer area. Therefore, impacts associated with those activities will be eliminated. Routine activities and associated impacts which would be eliminated in the buffer area include installation and operation of manmade structures, effluents and discharges from drilling discharges, and underwater noise from geophysical surveys. The probability of one or more oil spill of 1,000 bbl or greater occurring from production in the Southern California Planning Area is 28 percent. It is assumed that the oil will would not occur in the buffer area (Figure II.E.1-9). Although oil spill from a pipeline could move into the buffer area and contact fish populations within it, the likelihood is reduced. The large pipeline oil spill or two of the three tanker oil spills are expected to result in some lethal (less than 10%) or sublethal effects that would not be discernible from natural variations of pelagic offshore steelhead trout. However, a tanker oil spill contacting the entrance of a steelhead spawning stream in Washington or southern California (San Luis Obispo County), would result in a reduction of 10-20 percent of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regionally, impacts to the steelhead population would not be discernible from natural variations of steelhead trout populations within the area since not every stream in the region is affected. Further, the number of fish affected will be very small in relation to the overall population along the Pacific coast.

CONCLUSION: Adoption of Alternative V would eliminate impacts from routine operations in the buffer area located in the northern portion of the area under consideration. Routine activities would result in changes in the distribution of some migrating populations for a period of minutes to hours with no discernable change from natural variations of the steelhead trout population. The chance of spill related impacts occurring in the buffer area would be reduced as the result of this alternative. A tanker oil spill contacting the entrance of a steelhead spawning stream in Washington or southern California (San Luis Obispo County), would result in a reduction of 10-20 percent of the outmigrating population of that stream, with effects to the impacted year class lasting 2-4 years. Regional impacts would not be discernible from natural variations of steelhead trout populations within the area.

(c) Pacific Whiting

Impacts on Pacific OCS Region fishery resources from both normal development and accidental causes will be the same as those described for Alternative I discussed in Section IV.D.1.a(6), except in the buffer area. Routine operations will not occur in the buffer area. Therefore, impacts associated with those activities will be eliminated. Routine activities and associated impacts which would be eliminated in the buffer area include installation and operation of manmade structures, effluents and discharges from drilling discharges, and underwater noise from geophysical surveys.

The hypothesized level of development for Alternative V is reduced from Alternative I by one platform and an associated pipeline. The probability of one or more spills of 1,000 bbl or greater occurring from production in the Southern California Planning Area is 28 percent. It is also assumed that the oil spill would not occur in the buffer area (Figure II.E.1-9). Although oil spilled from a pipeline could move into the buffer area and contact whiting populations, the likelihood is reduced.

Tanker traffic is unaffected by this alternative, and as a result, whiting habitat throughout the planning area is at risk from a tanker spill. A tanker oil spill could cause mortalities to hundreds of whiting in the affected area. However, due to the widespread distribution of whiting, regional impacts from that spill would not be discernible from natural variations of populations. Overall, the large oil spills estimated for Alternative V are expected to result in some lethal (less than 10%), or sublethal effects that would not be discernible from natural variations of whiting populations.

CONCLUSION: Adoption of Alternative V would eliminate impacts from routine operations in the buffer area. Routine activities would result in changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. Oil spills would result in some lethal (less than 10%) or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally. The chance of these spill related impacts occurring in the buffer area would be reduced as the result of this alternative.

(d) Other Fish Resources

Impacts on Pacific OCS Region fishery resources from both normal development and accidental causes will be the same as those described for Alternative I discussed in Section IV.D.1.a(6), except in the buffer area. Routine operations will not occur in the buffer area. Therefore, impacts associated with those activities will be eliminated. Routine activities and associated impacts which would be eliminated in the buffer area include installation and operation of manmade structures, effluents and discharges from drilling discharges, and underwater noise from geophysical surveys.

The hypothesized level of development for Alternative V is reduced from Alternative I by one platform and an associated pipeline. The probability of one or more oil spills of 1,000 bbl or greater occurring from production in the Southern California Planning Area is 28 percent. It is also assumed that an oil spill would not occur in the buffer area (Figure II.E.1-9). Although oil spilled from a pipeline could move into the buffer area and contact fish populations, the likelihood is reduced.

Tanker traffic is unaffected by this alternative, and as a result, fish habitat throughout the planning area is at risk from a tanker spill. A tanker oil spill entering a stream during spawning season could cause mortalities to hundreds of fish in the affected stream and affect the impacted year class for two to four years. However, due to the widespread distribution of fish throughout the Pacific coast, regional impacts from that spill would not be discernible from natural variations of populations. Overall, the large oil spills estimated for Alternative V are expected to result in some lethal (less than 10%), or sublethal effects that would not be discernible from natural variations of fish populations.

CONCLUSION: Adoption of Alternative V would eliminate impacts from routine operations in the buffer area. Routine activities would result in reductions of some local fish populations, but with no lasting effects on trophically dependent predator species. Recovery of affected local populations would occur within 2 years. Oil spills would result in some lethal or sublethal effects locally in the area of contact, and the chance of this occurring in the buffer area would be reduced as the result of this alternative. Recovery of affected local populations would occur within 2 years. The chance of these spill related impacts occurring in the buffer area would be reduced as the result of this alternative. A tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for two to four years. Regionally, lethal or sublethal effects would not be discernible from natural variations of fish populations within the area.

(4) Atlantic Region

Impacts on fish resources can result from the discharge of muds, cuttings, formation or produced waters, and other operational effluents; pipelaying and platform emplacement; structure removal; lights on offshore rigs; and noise associated with geophysical surveys or routine drilling operations.

The general biological stipulation provides, special protection for any fish resources that the Regional Director identified as needing such protection. Species and habitats that may require safeguarding and the possible methods of protection are discussed in Section IV.D.1.a(6).

Small accidental operational hydrocarbon spills are assumed to occur. Oil may have lethal or sublethal effects on fish eggs, larvae, juveniles, and adults.

Under Alternative V, drill muds and cuttings would be discharged from 129 wells. Potential impacts of drill muds on fish resources are summarized in Section IV.D.1.a(6). Only water-based muds are permitted under NPDES regulations; most of these muds are relatively nontoxic (NAS, 1983;

Neff et al., 1987b). Sublethal or lethal impacts on ichthyoplankton may occur on the order of 10's or 100's of meters from the point of discharge. As discussed in Section IV.D.1.a(6), discharge of deck drainage and treated sanitary and domestic wastewaters are expected to cause sublethal effects on phytoplankton and zooplankton near the point of discharge. These organisms provide nutrition for commercially important finfish and shellfish. However, effects would be minor and localized, occurring within a few meters of the discharge point, and therefore no impacts on fish resources, not even on individual fish, are expected.

Gas pipeline emplacement constitutes the main source of mechanical disturbance assumed under Alternative V. Assuming that 182 km (113 mi) (which is one third of the total miles of trunkline under Alternative V) will be inside the 60-m (197-ft) isobath and thus require burial, pipeline emplacement there would disturb about 3.6 km^2 (1.4 mi^2) of ocean bottom. In contrast, the total area occupied by bottom-dwelling organisms such as surf clams is very large, as discussed in Section IV.D.1.a(6). Thus, no impacts on whole populations of shellfish, or benthic organisms that are forage for demersal predatory fish, are expected.

Five platforms are assumed in the mid- and south Atlantic under Alternative V. Platforms could act as artificial reefs and increase aggregation or production of fish, as discussed in Section IV.D.1.a(6). A total bottom area of only 0.10 km^2 (0.04 mi^2) would be disturbed by all five platforms combined. Therefore, only impacts on individual shellfish or benthic forage organisms for demersal fish and not on whole populations are expected. A total area of at least 1.5 km^2 (0.6 mi^2) would be affected by removal of all platforms using bulk explosives; other methods would disturb less area but could only be used under certain circumstances. For Alternative V, impacts on benthos associated with platform effects in the southern mid-Atlantic and south Atlantic are expected to be confined to organisms on the continental slope.

Impacts of airguns used in geophysical surveys are discussed in Section IV.D.1.a(6). These impacts are confined to individuals near the airguns. Although the distance traversed during a geophysical survey is considerable, lethal effects occur only within about 1.5 m (5 ft) of the airguns. Impacts of other man-made sounds, such as engine and ship propeller noises, are discussed in Section IV.D.1.a(6). Sounds originating from gas and oil operations are expected to result only in extremely localized effects on fish behavior and will not depress whole fish stocks. Lights on offshore rigs and platforms can attract some fish and can locally interfere with diel vertical feeding migrations. Species affected could be open-ocean mesopelagic forage fish migrating between the mesopelagic zone at depths of 200 to 1,000 m (656 to 320) and the epipelagic zone at depths of <200 m (<656 ft). In summary , sound and light would only be expected to affect individual fish and not whole populations of pelagic eggs, larvae juveniles, or adults of species of shelf, shelf-spawning estuarine-dependent, or open-ocean mesopelagic or epipelagic fish.

Formation water may be discharged from a well in conjunction with muds and cuttings, at the end of drilling (if the well is tested), or with oil or gas. Impacts of discharged formation water are discussed in Section IV.D.1.a(6). If necessary, formation water can be reinjected into deep rock strata. Minor osmotic stress to ichthyoplankton or adult of juvenile fish could occur within a few meters of the point of discharge of formation water, but no serious effects are expected.

Effects of oil spills on fish resources are summarized in Section IV.D.1.a(6). Oil may be taken up by aquatic organisms and metabolized. Metabolites are usually more easily excreted than parent compounds, but some are known carcinogens. Twenty spills >1 to 50 bbl and one spill of >50 to < 1,000 bbl are assumed. The most serious impacts are expected to be on low-energy shorelines, where accumulation and persistence of the oil in the sediments may cause recovery to take anywhere from 2 to at about 12 years (Teal and Howarth, 1984). However, a spill of 999 bbl (the largest possible spill assumed under Alternative V) is expected to contact only a small length of shoreline relative to the total shoreline of the mid-Atlantic and South Atlantic Bights. Under Alternative V, spills from platforms are not expected to reach shore because of the assumed 50-mi (81-km) buffer zone. A small oil spill may contact individual eggs and larvae of open-ocean pelagic species, shelf species, and shelf-spawning estuarine-dependent species. The time of year and location of the spill would determine the species that would be affected. In summary, sublethal or lethal effects on individual eggs, larvae, juveniles, or adults can occur. However, it is not expected that whole fish populations will be measurably affected.

Atlantic calico scallop beds could be disrupted if protection by stipulation were not in place. Typically, beds of Atlantic calico scallop on the Atlantic coast occur at depths to about 94 m (308 ft) (SAFMC, 1982), inside the depths at which platforms and drilling would be permitted by the 50-mi (81-km) buffer assumed under this alternative. However, pipelaying, the major source of mechanical disturbance from OCS gas and oil activities, would occur inside this buffer and could bury 0.1 to greater than 4 percent of an Atlantic calico scallop bed, as described in Section IV.D.1.a(6). Attached epiflora and epifauna of a live-bottom zone, which may encompass a restricted area, could be damaged by drillship anchors, platform emplacement and removal, and discharge of cuttings.

In summary, routine operations could result in sublethal effects on fish food organisms near the point of discharge of formation waters or fresh wastewater, especially within a distance of a few meters. Burial of benthic food organisms and shellfish will occur in the first phase of drilling, within a range on the order of 10's of meters of the wellhead. Trenching and jetting for pipeline emplacement in water less than 60 m (197 ft) deep will bury benthic organisms within about 10 m (33 ft) on each side of the pipeline. Five platforms are assumed under Alternative V, and emplacement of all of those platforms can damage a total area of 0.1 km2 (0.04 mi^2). Drilling rigs will be required for each of the 32 exploration and delineation wells assumed under Alternative V and 5 platforms are to be installed; lights and man-made sounds from such structures would have no impacts beyond the immediate vicinity of the sound or light source. Produced waters may osmotically stress fish within a few meters of the point of discharge.

Lethal or sublethal impacts on individual eggs, larvae, juveniles, or adults can result from a small oil spill. The most damaging effects are expected to result from inshore contamination of sediment or aquatic vegetation along an affected low-energy shoreline.

CONCLUSION: Individual finfish or shellfish may experience sublethal impacts or mortality. No measurable declines in whole stocks are expected. The anticipated duration of impacts on fish resources under Alternative V is less than one generation or 1 to 3 years. Fish population in the vicinity of oiled shorelines may require from 2 to about 12 years to recover.

g. Reptiles

(1) Gulf of Mexico Region

A number of routine events such as anchoring, structure installation, pipeline placement, dredging, operational discharges, discharges will be indistinguishable from the long-term (25-50 years) natural variability within populations of marine turtles. It is expected that marine turtles will avoid 5-10 m^2 of live bottom areas for up to a month and that this avoidance of impoverished foraging areas will have no effect on marine turtles. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of marine turtles to visually locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. The effects on marine turtles from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on marine turtles beyond 50 m of the detonation of a short-term nature lasting less than one week. No deaths are expected due to industry's adherence to the MMS guidelines for explosive removals.

Accidental events such as OCS-related trash and debris, oil spills, and oil spill response activities may adversely affect marine turtles. The effect on marine turtles from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 turtles. Four oil spills greater than or equal to 1,000 bbl from program-related activities and increased import tankering due to decreased domestic production have been described previously. The effect on marine turtles from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths affected by spilled oil will be replaced through natural recruitment from the next generation. It is expected that the effects from oil spill response activities would be sublethal to marine turtles causing avoidance of 100 ha of oiled coastal areas for one month.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a marine turtle, and no change in distribution or abundance. Any mortalities will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Pacific Region

Alternative V (Part H) would establish a buffer zone extending approximately 12 miles from the shoreline from the Santa Maria River north to Morro Bay (Figure II.E.1-9). This alternative would delete approximately 24 blocks in the northern Santa Maria Basin from consideration for leasing. The routine activities assumed to occur in the Pacific Region under this alternative decrease somewhat from those described for Alternative I, since the number of platforms assumed to be built is reduced by one, from seven to six. The pipeline associated with this platform is also eliminated. The accidental events assumed to occur remain the same as in Alternative I. The probability of one or more oil spills of 1,000 bbl or more occurring from production in the Southern California Planning Area is 28 percent. Therefore, expected impacts to sea turtles would remain the same. Section IV.D.1.a.(7) provides a discussion of potential impacts on sea turtles and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea turtles include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact sea turtle populations. The low sea turtle densities in the areas assumed to be affected (particularly north of Point Conception) make it unlikely that these animals would be affected by accidental oil spills; if mortality does occur, it is not expected to be distinguishable from natural variability within the species' populations.

CONCLUSION: Adoption of Alternative V (Part H) is expected to have no discernable effect on sea turtle abundance or distribution.

(3) Atlantic Region

Potential impact-producing factors associated with routine gas and oil operations include noise, the presence of platforms and artificial lighting, vessel and aircraft traffic, geophysical surveys, muds and cuttings discharges, and pipeline installation (see Sections IV.D.1.a). Other than accidental collisions between vessels and marine turtles, routine potential impact-producing factors are generally considered to be sublethal. Routine potential impact-producing factors associated with Alternative I are expected to be equivalent to or slightly higher than those which would be expected were Alternative V. This assessment is based on the similarities between the scenarios for Alternative I and Alternative V with respect to activity levels, infrastructure requirements, and scenario duration.

Impact-producing factors associated with accidental events center on the discharge of oil or refined hydrocarbons. Under Alternative V, the number of chronic operational discharges (less than 1 to 50 bbl) are the same as in Alternative I (20). One spill (50 bbl to <1,000 bbl) is assumed to occur offshore. No oil spill (1,000 bbl or greater) is assumed. Discussions concerning the potential impacts on marine turtles from spilled oil or other hydrocarbons are given in Sections IV.A.

If Alternative V were to be adopted, special protections will insure the safeguarding of endangered and threatened marine turtles. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriate actions to determine the extent of the marine turtle resource being affected and the degree to which potential impact-producing factors may affect marine turtles. The findings of these studies may result in the modification of activities associated with the scenario for Alternative V.

For information concerning the infrastructure, routine and accidental impacts, and the duration of this scenario, see Alternative I description (Section IV.D.1.a(7)). Differences between Alternative I and Alternative V have been described previously. Although there is a reduction in some activities, potential impacts are not expected to exceed those of Alternative I for routine OCS gas and oil activities.

The major difference between Alternative I and this scenario is the deferral of all blocks located within 82 km (50 mi) from shore. The blocks deferred offshore Cape Hatteras and Cape Lookout under Alternative V are pelagic habitat of leatherback turtles (see Section III.D.2). These blocks are also habitat for passively migrating juvenile loggerhead and green turtles (see Section III.D.2). Other species and age groups which have a primarily inshore distribution may experience a slight benefit from the adoption of Alternative V but it is not expected that these species would experience levels of impacts from routine OCS gas and oil activities which would differ measurably from those expected under Alternative I.

The assumptions for accidental discharges and small spills of hydrocarbons are identified in the introduction to this discussion. Most accidental discharges are assumed to occur offshore or within the vicinity of supply bases. Offshore chronic operational discharges and those which may occur inshore are not expected to measurably affect populations of marine turtles within these areas. The impacts of 1 small spill over the 30-year life of the Alternative V are not expected to result in measurable impacts on marine turtles.

More common would be loggerhead, green, and juvenile Kemp's ridley turtles due to these species' preference for coastal waters with productive benthic habitats. Although Kemp's ridley juveniles tend to occupy habitat further inshore, such as the lower Chesapeake Bay and mouths of major river tributaries, it is probable that seasonal migrants from juvenile and subadult developmental habitat located further to the north (e.g., Delaware Bay and Long Island Sound), transit these blocks and adjacent inshore habitat.

The adoption of Alternative V may slightly reduce the potential for routine OCS gas and oil activities and accidents to contact and possibly affect individual endangered and threatened marine turtles. Impacts under this alternative are not expected to measurably differ from those anticipated for Alternative I (Section IV.D.1.a(7)).

Even in the absence of special protections, it is not expected that measurable impacts on endangered and threatened marine turtle species would occur.

CONCLUSION: No measurable changes in the population size, distribution, and behavior of endangered and threatened marine turtles on the Atlantic OCS are expected under Alternative V.

h. Impacts on Coastal Habitats

(1) Gulf of Mexico Region

(a) Wetlands and Estuaries

The disposal of OCS-derived produced waters in coastal Louisiana is not expected to affect adjacent wetland areas based on the results of field studies. New dredging and construction projects in wetland areas include pipeline landfalls, navigation channel maintenance dredging and deepening, and new infrastructure construction. The four new pipeline landfalls are expected to affect 27 ha of wetlands. Maintenance dredging and deepening of navigation channels will affect wetlands mainly in coastal Louisiana where wetlands typically fringe navigation routes. In addition, the use of channels by OCS vessels will result in accelerated erosion of as much as 30 ha of wetland fringed channel banks. The construction of one new pipe yard and three new terminals is projected to occur along the south Texas and Alabama coasts where ample amounts of upland occur near the coast. Given the current regulatory environment, it is likely that these facilities will be constructed on coastal uplands rather than wetlands.

Four oil spills greater than or equal to 1,000 bbl are assumed to occur from program-related activities and increased import tankering due to decreased domestic production have been described previously. Impacts from accidental discharges of oil could affect approximately 100 ha of wetlands, mainly along the western Louisiana to eastern Texas coasts. In the areas affected, damage to wetlands will include temporary die back of the above ground vegetation, some complete plant death, and accelerated rates of land loss (the conversion of wetlands to open water). The establishment of this alternative will eliminate all oil production activities within 50 km of the Florida coast. Even without the emplacement of the two oil-spill response stipulations that apply to OCS activities offshore Florida, an oil spill occurrence located greater than 50 km from shore will not result in contact to the coast. No oil spill contacts to the Florida coast, therefore, are assumed to occur under the alternative.

CONCLUSION: This alternative is expected to result in temporary (one growing season or approximately 6 months) dieback of up to 100 ha of wetlands that have been contacted by spilled oil. Some of these wetland areas could be converted to open water habitat where higher concentrations of oil accumulated resulting in plant mortality and eventual land loss. The probability of one or more spills (greater than or equal to 10,000 bbl) occurring ranges up to 22 percent. Up to 30 ha of wetlands could be eroded along navigation channels as a result of OCS-vessel traffic within the channels. Most wetland impacts will occur in Louisiana and along the north Texas coast.

(b) Barrier Beaches

Construction activities associated with this alternative, including pipeline landfalls, infrastructure construction, and maintenance dredging and deepening of navigation channels, are expected to have minimal impacts. Using proper construction techniques, pipeline landfalls can be done with no observable effects on barrier beaches. New construction projects will not likely be located on barrier beaches or islands. Maintenance dredging and channel deepening may have some erosional effects on beaches downdrift from the navigation channel, but these impacts will be localized.

Four oil spills greater than or equal to 1,000 bbl are assumed to occur from program-related activities and increased import tankering due to decreased domestic production have been described previously. Although some contact to barrier beaches from accidental spillage of oil will occur along the Louisiana and Texas coasts, the oil will be cleaned from the beach with no permanent affects on the configuration of the barrier feature. The establishment of this alternative will eliminate all oil production activities within 50 km of the Florida coast. Even without the emplacement of the two oil-spill response stipulations that apply to OCS activities offshore Florida, an oil spill occurrence located greater than 50 km from shore will not result in contact to the coast. No oil spill contacts to the Florida coast, therefore, are assumed to occur under the alternative.

CONCLUSION: This alternative is not expected to result in permanent alterations of barrier beach configurations, except in localized areas near navigation channels that have been dredged and deepened.

(2) Alaska Region

WETLANDS AND ESTUARIES: Alternative V generally would reduce the chances of platform oil spills contacting wetland-estuarine habitats along the coast of the Chukchi Sea Planning Area and along the northern part of the Hope Basin-Point Hope polynya by the deferral of leasing activities nearshore along the coast. The number of oil spills of 1,000 bbl or greater assumed to occur in the Chukchi Sea Planning Area would be reduced from three to two under this alternative (Part C-1), and the number of small spills assumed to occur in the Arctic also would be less than Alternative I. The amount of wetlands and estuaries in the Chukchi Sea Planning Area that would be contaminated would be reduced perhaps 5 to 10 percent under this alternative. However, wetland-estuarine habitats along the coast of the Beaufort Sea and wetland-estuarine habitats in the Gulf of Alaska (in

Cook Inlet and in Prince William Sound) are expected to be equally affected under this alternative as under Alternative I.

The deferral of leasing within 12 miles (rather than 9 miles) of the Yukon Delta would slightly reduce the risk of oil-spill contact to Yukon Delta wetlands and estuaries, but the additional 3-mile buffer would provide little protection from spills during storm surges.

A 30-mile buffer around St. George Island is not expected to reduce effects on important wetlands and estuaries because these habitats are not present on St. George Island.

The proposed Dry Bay-Fairweather Grounds deferral is expected to only slightly reduce oil-spill-contact risks to these habitats, as the spill risks from tanker transportation through the area remains the same as described under Alternative I.

Under this alternative, the primary effects on wetland-estuarine habitats in the Alaska Region are expected to come from a causeway and pipeline-landfall construction and oil spills. Hydrological effects from the causeway (changes in the physical integrity of perhaps 5% of the habitat) and some effects (perhaps 5-10%) on the distribution of species (anadromous fish) are expected to last for more than 10 years. Turbidity effects from pipeline burial on wetland-estuarine habitats are expected to be short term, lasting less than 2 years. Oil-spill contamination of wetland-estuarine habitats is expected to have adverse effects on the biological diversity and productivity of invertebrate communities lasting for more than 10 years.

The potential impacts of either of two coastal buffers identified for the Chukchi Sea are expected to cause the same impacts. There are two principal reason for this: (1) the activities that are assumed to occur under each buffer alternative are essentially the same, and (2) the mitigation potential provided by the buffers is largely duplicated by measures that are already included as part of the alternative.

CONCLUSION: The impacts of Alternative V on wetland-estuarine habitats along the coast of the Chukchi Sea northern Hope Basin, Yukon Delta, and Dry Bay area are expected to be somewhat less than Alternative I. However, wetland-estuarine habitats along the coast of the Beaufort Sea and wetland-estuarine habitats in the Gulf of Alaska (in Cook Inlet and in Prince William Sound) are expected to be equally affected under this alternative as under Alternative I. There is an 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 24- to 32-year life of the alternative in the Alaska Region.

(3) Pacific Region

WETLANDS AND ESTUARIES: If Alternative V, Coastal Buffers, were selected, impacts from normal activities are not expected to occur within the buffer area. Although it is assumed an oil spill will enter an estuary in northern Washington and southern California, the chance of an oil spill entering Morro Bay or the Santa Maria River is reduced since no pipeline will be installed in the northern Santa Maria Basin. Impacts from a large oil spill entering an estuary and remaining for several tidal cycles, will involve destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require at least 5 years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no real interference with ecological relationships in the region. The probability of an oil spill from a tanker carrying Alaska production ranges from 55 to 95 percent, and the probability of one or more spills of a 1,000 bbl or greater occurring is 28 percent. No impacts to estuaries were expected in northern California, as the spill was assumed to occur more than 50 miles offshore and not contact nearshore areas.

CONCLUSION: Adoption of Alternative V would result in impacts if a large oil spill entered an estuary and remained for several tidal cycles, will involve destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require at least 5 years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no measurable interference with ecological relationships in the Southern California Planning Area.

(4) Atlantic Region

(a) Wetlands and Estuaries

Routine OCS activities that could impact estuaries or wetlands under this alternative stem from supply vessel and tanker traffic to and from drilling rigs and platforms, and from the emplacement of gas pipelines in the coastal area.

Accidental events that could impact estuaries and wetlands arise from small spills of diesel fuel from supply vessels and small to large spills from tankers transporting crude oil to refineries. Supply vessel spills that could impact estuaries and wetlands would most likely occur only in the immediate vicinity of the areas used as support bases. The greatest chance of a spill up to 1,000 bbl affecting estuaries and wetlands would be in the vicinity of refineries. Oil produced on the Atlantic OCS would most likely be transported by tankers to refineries in Delaware Bay or possibly Raritan Bay. An oil spill greater than or equal to a 1,000 bbl is not assumed under Alternative V.

Impacts on estuaries and wetlands from vessel traffic related to OCS activities stem from ship wakes eroding the shoreline. Since all vessel traffic is assumed to use established port facilities, impacts are expected to be negligible.

Construction of pipelines in the coastal area can affect estuarine and wetland areas. Pipelines coming ashore in the Mid-Atlantic Bight are not assumed to encounter estuaries and wetlands but will come ashore in areas where the beach is part of the mainland. This is the case at Seagirt, NJ and Cape Henry, VA. In the South Atlantic Bight, a pipeline is assumed have to pass through some estuarine or wetland environments. Most of the effects from a pipeline are expected to occur during construction. The effects of the various construction methods are explained in Section IV.D.1.a(8). While complete recovery of the area disturbed during pipeline construction can take several years, the direct impacts affect only a limited area and are temporary. Pipeline corridors are expected to revegetate in 2 years. Proper construction and restoration methods will allow the area to return to preconstruction conditions and are not expected to result in modification of water flow, loss of wetlands, or altered salinity regimes.

Small spills from supply vessels are not expected to affect estuaries and wetlands in the vicinity of the support bases for any more than one growing season. These small spills are assumed to be diesel fuel which would evaporate or be cleaned up with sorbents before they could penetrate into the sediment and endanger the root systems of marsh and sea grasses.

Impacts from OCS vessel traffic are expected to be imperceptible. Pipeline construction will temporarily destroy vegetation and habitat along the pipeline corridor. With proper reconstruction, revegetation can occur in 2 years. These impacts are expected only if pipelines come ashore near Wilmington, North Carolina, or Charleston, South Carolina. Impacts from accidents are expected to be limited to temporary changes in flora and fauna compositions caused by small spills in the vicinity of support bases. These are expected to be imperceptible in areas with existing daily ship traffic, such as Atlantic City, New Jersey, and Morehead City, North Carolina.

CONCLUSION: Under Alternative V, impacts on estuaries and wetlands are expected to be imperceptible except in areas disturbed for pipeline construction. Pipeline corridor impacts will be of limited extent (less than 0.5%) of Atlantic estuarine environment with pre-impact conditions returning in approximately 2 years.

(b) Shorelines

Routine OCS activities that could impact shorelines under this Alternative stem from supply vessel and tanker traffic between shore bases and drilling rigs and platforms, and from the emplacement of gas pipelines in coastal areas.

Accidental events that can impact shorelines such as small spills of diesel fuel from supply vessels and spills from tankers transporting crude oil to refineries have been described previously. Supply vessel spills that can impact shorelines will most likely occur in the immediate vicinity of the areas used as support bases. The greatest chance of a spill up to 1,000 bbl affecting shorelines will be in the vicinity of refineries. Oil produced on the Atlantic OCS will most likely be transported by tankers to refineries in Delaware Bay or possibly Raritan Bay. An oil spill (1,000 bbl or more) is not assumed under Alternative V.

The wakes from vessels related to OCS activities can cause erosion of the shoreline. Since all vessel traffic is assumed to use established port facilities, these impacts are expected to be imperceptible. The only measurable impact on shorelines expected from the assumed routine activities is from dredging channels through one beach area in the Mid-Atlantic Bight and through two barrier islands in the South Atlantic Bight to allow for pipeline emplacements. The dominant impact would be aesthetic; however, this would weaken the barrier islands until vegetation is reestablished (approximately 2 to 3 years.). This temporary weakening will most likely not cause the barrier island to be breached by subsequent storms. Proper construction methods will almost certainly prevent this from happening.

It is assumed that a small diesel fuel spill between 1 and 50 bbl will occur in the vicinity of each of the support bases and at the mouth of Delaware Bay. Impacts that could be expected to shorelines, if these spills occur, will be mostly visual and last only for a few days. Most of the diesel fuel is expected to evaporate with in one day, with any remaining fuel dissipating from the rapid sand movement that occurs along the Atlantic shorelines. No measurable impact to shorelines is expected from small spills.

CONCLUSION: Under Alternative V, impacts to shorelines will occur only at pipeline landfall locations. The maximum area affected will be a 15 m (50 ft) swath across the beach. Recovery is expected to be complete in 2 to 3 years.

i. Impacts on Seafloor Habitats

(1) Gulf of Mexico Region

(a) Chemosynthetic Communities

Because of the water depths (400+meters) at which these communities are found, the only impact-producing factor threatening the chemosynthetic communities is physical disturbance of the bottom, which would destroy the organisms comprising these communities. Such disturbance would come from those OCS-related activities associated with pipelaying, anchoring, structure emplacement, and seafloor blowouts. Only structure emplacement is considered to be a threat, and then only to the high-density (Bush Hill-type) communities. The widely distributed low-density communities would not be at risk. The provisions of NTL 88-11 (currently in effect), requires surveys prior to drilling and avoidance. This will greatly reduce, but not completely eliminate, the risk.

CONCLUSION: The activities associated with this alternative are expected to cause little damage to the physical integrity, species diversity, or biological productivity of either the wide-spread low-density chemosynthetic communities or the rarer, widely scattered high-density Bush Hill-type chemosynthetic communities. Recovery from any damage is expected to take less than two years.

(b) Topographic Features

Impact-producing factors resulting from routine activities of oil and gas exploration and development include anchoring, structure emplacement and removal, and operational discharges (muds and cuttings, produced water). These activities may threaten the communities of the topographic features. Because protections similar to that of the topographic features stipulation are assumed to be attached to leases issued as a result of this alternative, operational discharges (drilling muds and cuttings, produced waters) will have no impact on the biota of the banks.

Impact-producing factors resulting from accidents during such oil and gas activities include blowouts and oil spills. These activities may threaten the communities of the topographic features. Because protections similar to that of the topographic features stipulation are assumed to be attached to leases issued as a result of this alternative, such activities cannot occur within the no activity zones, which include all the sensitive reefal habitats. Thus there will be no mechanical damage to reefs resulting from blowouts. Suspended sediments from a blowout may reach the biota of the bank, but in very small amounts that will be swept clear of the bank in a matter of a few hours. Impacts would be sub-lethal at worst, and recovery would take place within 1-3 days. Oil spills could cause damage to benthic organisms if the oil contacts the organisms and remains in contact for an extended period of time. Four oil spills greater than or equal to 1,000 bbl from program-related activities and increased import tankering due to decreased domestic production have been described previously. Oil from surface spills will not contact the reefs, and contact from oil is likely only from spills from blowouts, which are rare in the Gulf. As with resuspended sediments, such oil would reach a bank only in very small amounts that will be swept clear of the bank in a matter of a few hours. Impacts would be sub-lethal at worst, and recovery would take place within 1-3 days.

CONCLUSION: In light of the analyses and assumptions above, including the protections similar to those of the topographic features stipulation, the activities associated with this alternative are expected to cause little to no damage to the physical integrity, species diversity, or biological productivity of the habitats of the topographic features of the Gulf of Mexico. Small areas of 5-10 m^2 would be impacted, and recovery from this damage to pre-impact conditions is expected to take less than 2 years, probably on the order of 2-4 weeks.

(c) Live Bottoms

The impact-producing factors resulting from routine activities of oil and gas operations include mechanical damage caused by underwater oil spills, blowouts, anchoring, structure emplacement and removal, drilling discharges, and pipeline emplacement. These activities may threaten the sessile and pelagic communities associated with the crest and flanks of the hard bottom and low-relief hard-bottom features of the region. Because protection similar to that of the biological stipulations are assumed to be attached to leases issued as a result of this alternative, the effects from these factors will have been mitigated on the biota of the hard bottoms.

The placement of drilling rigs, platforms, and anchors on the seafloor will crush the organisms directly beneath the legs or mat used to support the structure. Structure placement and anchor damage from support boats and ships, floating drilling units, and pipeline-laying vessels disturbs areas of the seafloor and is the most serious threat to live-bottom areas at these depths. Structure removal using explosives (the most common removal method) could suspend sediments throughout the water column to the surface and may cause substantial impacts to nearby habitats. Deposition of these sediments would occur largely within the first 100 m of the site. Explosive structure removals create shock waves, which could also harm resident biota in the immediate vicinity. Smothering of organisms through deposition of drilling discharges (drill muds and cuttings) may occur; less obvious sublethal effects may also take place. Pipeline emplacement directly affects the benthic communities through burial and disruption of the benthos, and through resuspension of sediments. These resuspended sediments may clog filter-feeding mechanisms and gills of fishes and sedentary invertebrates. The majority of these impacts are mitigated through implementation of the biological stipulations or comparable measures. Because protection similar to that of the biological stipulations will be attached to leases issued as a result of this alternative, the effects from these factors will have been mitigated on the biota of the region.

Oil spills could cause damage to live-bottom organisms if the oil contacts the organisms and remains in contact for an extended period of time. The potential impacts from spilled oil include uptake of hydrocarbons and reduced visibility; these impacts may be serious or fatal to the local biota. Four oil spills greater than or equal to 1,000 bbl from program-related activities and increased import tankering due to decreased domestic production have been described previously. Oil from surface spills will not contact live-bottom areas, and contact from oil is most likely only from spills from blowouts, which are rare in the Gulf. A blowout within a 100 m of a hard bottom community could result in the smothering of the biota within a very limited area of a hard bottom due to sedimentation.

This alternative would slightly change some of the OCS-related activities which were detailed for the proposed action. A slight reduction in the number of exploration and delineation wells would be evident due to the 30-mile nearshore buffer zone. Likewise, a similar reduction in the number of development and production wells, number of platform installations and removals, miles of pipelines installed, and potential oil spills would be seen. However, the live-bottom stipulation effectively mitigates the effects of OCS-activities on hard-bottom communities.

CONCLUSION: The impact of this alternative on the hard bottom trend region is expected to be such that any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 2-4 months.

(2) Alaska Region

STEFANSSON SOUND BOULDER PATCH: General and specific impacts expected to be experienced by the Boulder Patch from routine activities and accidental events potentially occurring with Alternative V are identical to those analyzed in Section IV.D.1.a(9). Because the resource does not exist in the deferral areas, the analysis and resulting conclusion will remain the same as described in Alternative I.

CONCLUSION: If Alternative V is adopted, oil-spill effects on the productivity and diversity (perhaps 1-2%) of the Boulder Patch benthic organisms are expected to persist for 2 years. Turbidity and sedimentation effects on the growth and productivity of benthic organisms (perhaps 1-2%) of the Boulder Patch from pipeline burial and causeway construction are expected to persist for about 2 years.

(3) Pacific Region

(a) Intertidal Benthos

If Alternative V, Establish Coastal Buffers, were selected, impacts from normal activities are not expected to occur in the buffer area since no oil and gas operations will occur north of the Santa Maria River. Although it is assumed an oil spill will contact intertidal communities in northern Washington and southern California, the chance of it contacting intertidal areas in the buffer zone is reduced since no pipeline will be located in the northern Santa Maria Basin. Although the probability of impacts to intertidal communities in the buffer area are reduced, impacts will be identical with those of Alternative I (see Section IV.D.1.a(9)). An assumed pipeline oil spill (28% probability that one or more spills of 1,000 bbl or greater will occur) and two of the three tanker oil spills one in Washington and one in southern California are expected to result in smothering and immobilization to portions of local sandy beach intertidal populations of contacted by the spill. Recovery is expected to occur within a year.

Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community contacted by the spill. Recovery could be retarded in some species for a year with some assemblages in the community requiring 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis. A tanker spill in northern California was assumed to occur further offshore and not expected to come ashore. Therefore, no impacts to intertidal areas were expected in northern California.

CONCLUSION: If Alternative V is adopted, impacts from oil spills are expected to result in smothering and immobilization to portions of local sandy beach populations contacted by the spill. Recovery is expected to occur within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community contacted by the spill. The chance of these impacts occurring in the buffer area would be reduced as the result of this alternative. Recovery for assemblages within the rocky intertidal community could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis.

(b) Subtidal Benthos

All impacts on subtidal benthic communities from both normal development and accidental causes will be the same as those described for the base case discussed in Section IV.D.1.a(9), with the exception of the buffer area. The elimination of one platform in the buffer area will prevent impacts caused by pipeline and platform installation and drilling discharges from originating in the buffer area. In the area outside the buffer, platform installation, pipeline construction and associated anchoring activities would eliminate thousands of benthic organisms in the 20 m (65 ft) pipeline corridors and at the platform site. Similar effects would occur in the areas impacted by positioning anchors. Affected hard bottom communities would require at least five years to recover from disturbance caused by construction activities, due to the slow recovery of its associated biotic community. Soft bottoms may recover within two years, however, due to greater emigration both from outside the disturbance area, and recovery from burial within.

The areal extent of bottom habitat disturbed by platform installation is approximately 25 ha (10 ac) per site. This impact, involving the loss of benthic animals and alteration of the composition of the site specific population would last well beyond the life of the platform since the physical presence of the platform will continue to cause the bottom alteration. Particularly for hard bottoms, recovery would require many additional years after the platform is eliminated due to the scarcity of hard bottoms as a biological resource and the long recovery period of hard bottom organisms.

However, impacts from development activities on the subtidal benthos from routine operations are not expected to measurably impact subtidal organisms in the Pacific OCS Region.

If Alternative V is adopted, the chance of a pipeline oil spill occurring is decreased slightly, and eliminated in the buffer area. Although a pipeline spill could move into the buffer area, and contact bottom communities, the likelihood of this is reduced. An oil spill will result in the loss or functional disruption of a few assemblages or communities at local areas within the region. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of thousands of individuals, resulting in alterations of ecological relationships with recovery requiring at least two years.

CONCLUSION: Adoption of Alternative V would eliminate impacts from routine operations in the buffer area. Routine operations are not expected to measurably impact subtidal organisms or communities in the Pacific OCS Region. An oil spill is expected to result in the loss or functional disruption of a few assemblages or communities at local areas within the region. The chance of this occurring in the buffer area is reduced as the result of this alternative. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality causing alterations of ecological relationships within that community, lasting for at least two years. Functionally, oil contact with a few hard bottom communities would not cause interference with regional ecological relationships or population levels.

(4) Atlantic Region

(a) Benthic Communities

With the exception of the number and length of gas pipelines, routine activities assumed under Alternative V decrease by approximately 10 percent compared to Alternative I (Section IV.D.1.a). As in Alternative I, 20 small (>1 to 50 bbl) operational oil spills and 1 larger (<50 to >1,000 bbl) oil spill are assumed to occur. No oil spills greater than or equal to 1,000 bbl are assumed under this scenario. For a description of special protections which may be required by the Regional Director, see Alternative I (Section IV.D.1.a(9)).

Adoption of Alternative V will defer 150 blocks, primarily off North Carolina, from consideration for lease. Benthic communities in this area, particularly near Mobil's proposed drill site in Block 467, are characterized by unusually high densities of organisms (Section III.C.3.b; USDOI, MMS, 1990f). If Alternative V is adopted, impacts to these communities would be eliminated. In the remaining areas considered for leasing, impacts from routine OCS activities would be similar to those described under Alternative I (Section IV.D.1.a). The principal effect on benthic communities from routine activities is associated with the discharge of drilling muds and cuttings to the seafloor (see Section IV.D.1.a). Benthic communities in the immediate vicinity of the drilling discharges would be subject to burial. Sublethal physiological effects, behavioral effects, and bioaccumulation of heavy metals also could occur in organisms exposed to drill muds downcurrent from the discharge point. Recovery of these deepwater benthic communities could proceed slowly (3 to 5 years) and probably result in recolonization by a different assemblage of organisms.

Emplacement of pipelines will result in disturbance of benthic communities along the route. The primary effect from the emplacement of trunklines and gathering lines occurs in shallow water (60 m [200 ft]) where pipelines must be buried (Section IV.D.1.a). Adoption of Alternative V will not change the expected impacts on benthic communities from those outlined in Alternative I.

Although no oil spill of a 1,000 bbl or more is assumed under this scenario, small operational spills and 1 larger oil spill are expected to release hydrocarbons into the marine environment. However, considering the depths at which these benthic communities are located, no impacts which could be distinguished from natural variation are expected to occur from these oil spills (Section IV.D.1.a).

In the absence of special protections, impacts on areas with unique communities or biological resources could occur under this scenario. Especially vulnerable to OCS activities are the live bottom habitats of the South Atlantic (Section IV.D.1.a).

If Alternative V is adopted, impacts on unusual benthic communities off Cape Hatteras would be eliminated. Impacts on the remaining benthic communities are expected to be similar to those described under Alternative I. The major effect from routine OCS activities will be the mortality by burial of individuals within several hundred meters of the wellhead. At the depths at which the proposed activities would occur, recovery of locally affected communities is expected to proceed slowly (3 to 5 years) and possibly result in recolonization by a different community. Recovery of nearshore communities from pipeline trenching activities is expected to occur within 1 to 3 years. No impacts on benthic communities associated with the release of hydrocarbons are expected.

CONCLUSION: Changes in benthic communities are expected to result only from routine activities and, except for very localized areas surrounding wellheads, are not expected to last longer than 1 to 3 years.

(b) Submarine Canyons

The deferral of 150 lease blocks within 82 km (50 mi) of shore will result in a decrease in routine OCS activities of approximately 10 percent. However, because none of the submarine canyons would be affected by the deferral of these lease blocks, no change in overall impacts to submarine canyons compared to Alternative I (Section IV.D.1.a) is expected. For a description of special protections which may be required by the Regional Director, see Alternative I (Section IV.D.1.a).

Impacts on submarine canyons from routine activities are primarily associated with the discharge of drilling muds and cuttings to the seafloor (Section IV.D.1.a). In the high energy environment of the open ocean, only discharges to the seafloor are expected to affect canyon communities. The major effect of these discharges will be the burial of many sessile individuals in the vicinity of the wellhead. Because no submarine canyon occurs within or even near the blocks potentially deferred under

Alternative V, adoption of this alternative would not change impacts from those described in Alternative I (Section IV.D.1.a).

Hydrocarbons from oil spills eventually could become incorporated into canyon sediments through transport and resuspension of sediments containing oil. However, because canyons are located in the open ocean where an oil spill would be widely dispersed, and because even the shallowest portions of canyons are in deep water, impacts on canyon communities from an oil spill of even 50 to 1,000 bbl are not expected.

Adoption of this alternative will not alter impacts on submarine canyons as outlined in Alternative I. No impacts from small operational spills or even a larger oil spill are anticipated.

CONCLUSION: Impacts on submarine canyons from routine activities are expected to result in alterations to the canyon communities, including declines in abundance and/or distribution of canyon species. These potential effects are not expected to last more than 1 to 3 years.

j. Impacts on Coastal Communities

(1) Gulf of Mexico Region

(a) Demography and Employment

Deletion of a 30-mile buffer along the northwest Florida coast would only slightly reduce the level of exploration, development, and production activity relative to the proposed action, as well as the associated Gulfwide employment. A total of approximately 345,000 person-years of employment (direct, indirect, and induced) are required during the 45-year life of this alternative. The States of Louisiana, Mississippi, and Alabama are expected to collectively provide over 79 percent of the total employment required in support of this alternative. Texas contributes approximately 19 percent of the Gulf Region employment impact. The least impacted state in the Gulf of Mexico Region is Florida, accounting for only two percent of the employment impact projected for the socioeconomic impact area as a result of this alternative. Four oil spills (greater than or equal to 1,000 bbl) from program-related activities and increased import tankering due to decreased domestic production have been described previously. Employment projected to result from oil spill clean-up activities due to this proposed alternative is approximately equivalent to 580 person-years of employment. It is expected that employment demands in support of the alternative will be met with the existing population and available labor force.

CONCLUSION: This alternative is expected to result in less than a 2 percent reduction in employment (direct, indirect, and induced) during its 45-year life with a 30-mile buffer. Peak levels of employment are expected to occur in the year 2000, with a total of approximately 16,400 workers involved in primary, secondary, and tertiary industries. Exploratory activities, which occur during the first 17 years of the life of the proposed alternative, are the main contributor to peak year employment. The greatest impact is expected in the coastal communities of Louisiana. However, it is expected that employment demands will be met with the existing population and available labor force.

(b) Public Services and Community Infrastructure

Deletion of a 30-mile buffer along the northwest Florida coast would only slightly reduce the level of exploration, development, and production activity, and associated employment, relative to the proposed action. Impacts to social patterns would be related to the dramatic changes in population and the disruption of environmental resources, as well as conditions inherent to OCS-related employment (i.e., work scheduling and rate of pay). No positive net migration into northcentral and northwestern Gulf coastal areas is expected to occur from those currently employed in the oil and gas industry, as well as the unemployed and underemployed, and new employees already living in the area. It is expected that jobs created by the alternative would likely reduce the amount of out-migration when compared to scenarios without Alternative I and that minor displacement from traditional occupations will occur as a result of the alternative. This displacement will be mitigated, to some extent, by the extended work schedule associated with OCS-related employment. The work schedule is expected to have some deleterious effects on family life in some individual cases. Impacts caused by the displacement of traditional occupations and relative wages are expected to occur to a minimal extent. Deletion of a 30-mile buffer zone along the northwest coast of Florida would not be expected to impact public services and community infrastructure of the area given the levels of services and infrastructure found in the northeastern Gulf and the limited amount of employment expected under the proposed action.

CONCLUSION: Under this alternative, minimal stress on public services and community infrastructure would occur.

(c) Social Patterns

Deletion of a 30-mile buffer along the northwest Florida coast would only slightly reduce the level of exploration, development, and production activity, and associated employment, relative to the proposed action. Impacts to social patterns would be related to the dramatic changes in population and the disruption of environmental resources, as well as conditions inherent to OCS-related employment (i.e., work scheduling and rate of pay). No positive net migration into northcentral and northwestern Gulf coastal areas is expected to occur from those currently employed in the oil and gas industry, as well as the unemployed and underemployed, and new employees already living in the area. It is expected that jobs created by the alternative would likely reduce the amount of out-migration when compared to scenarios without Alternative I and that minor displacement from traditional occupations will occur as a result of the alternative. This displacement will be mitigated, to some extent, by the extended work schedule associated with OCS-related employment. The work schedule is expected to have some deleterious effects on family life in some individual cases. Impacts caused by the displacement of traditional occupations and relative wages are expected to occur to a minimal extent. Adoption of the alternative would preclude visual impacts of OCS oil and gas platforms from the northwest coast Florida beaches, however, it may not serve to alleviate fears of some individuals and groups concerning potential environmental impacts of OCS oil and gas activity offshore Florida.

CONCLUSION: Under this alternative, deleterious impacts to family life are expected to occur in some individual cases, as are minimal impacts to traditional occupations. Visual impacts along the northwest Florida coast would be alleviated.

(2) Alaska Region

(a) Demography and Employment

The scenario assumptions in the Alaska Region for Alternative V are almost the same as Alternative I. The number of wells for Alternative V is the same or nearly the same as Alternative I.

Oil spills could occur in any one of the planning areas. As for Alternative I, it is assumed that most employment associated with oil-spill cleanup would be in locations separated from regional centers, but the actual hiring and population increase would occur in the regional centers. The number of spills is one less for Alternative V than Alternative I for the Beaufort Sea and Chukchi Sea sales but the same for the other sales.

Impacts on demography and employment that would result from the routine aspects of Alternative V, Establish Control Buffers, would be concentrated in regional centers. For Barrow (regional center for Beaufort and Chukchi Seas), Kotzebue (Hope Basin), Nome (Norton Basin), St. Paul, St. George, and Unalaska and Dutch Harbor (Navarin and St. George Basins), local employment generated by OCS activity is expected to be more than 5 percent but not more than 10 percent of projected employment for 2 to 5 years, and no sector of the local labor force is expected to change by more than 10 percent.

For Cook Inlet, the impacts are expected to be such that local employment generated by OCS activity in the peak years of OCS employment accounts for more than 1 percent but less than 5 percent of the projected level of employment for the affected area for less than 2 years, and no sector of the local labor force changes more than 10 percent.

For the Gulf of Alaska, the cumulative impacts on employment and demography are expected to be that local employment generated in regional centers by OCS activity accounts for more than 5 percent but no more than 10 percent of the projected level of employment of the affected area for 2 to 5 years, and no sector of the local labor force is expected to change more than 10 percent.

Population increases are expected to be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole would be between 1 and 5 percent for less than 2 years with no change in any sector of the State labor force greater than 10 percent. The principal cause of this impact is that employment and population directly in OCS-related activity generate secondary employment on a routine basis.

Impacts of demography and employment that are expected from oil spills are as follows. For each of the six OCS planning areas, an oil spill would generate up to 15 jobs in the closest regional center for up to 1 month. The size of the population increase is expected to be the same as the employment increase, because it is assumed no families would accompany these workers for such a short period of time.

Given that the scenarios for the two Chukchi Sea buffer alternatives are essentially the same and that measures to protect coastal resources are already part of the proposed program, no substantive differences between the impacts of these two alternatives were found.

CONCLUSION: The impacts of Alternative V on demography and employment are the same as Alternative I. For the regional centers for the Beaufort, Chukchi, Navarin, St. George, and Gulf of Alaska sales, local employment is expected to be more than 5 percent but not more than 10 percent of projected employment for 2 to 5 years, and no one sector of the local labor force is expected to change by more than 10 percent. For the Cook Inlet, local employment generated accounts for 1 to 5 percent for less than 2 years, and no sector of the local labor force changes more than 10 percent. Population increases are expected to be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole is expected to be between 1 and 5 percent for less than 2 years with no change in any sector of the State labor force greater than 10 percent. An oil spill would generate up to 15 jobs in the closest regional center for up to 1 month.

(b) Land Use

The establishment of coastal buffer zones will neither expand nor diminish the amount of infrastructure required to produce the sales' hydrocarbon potential. The resource estimates for unleased resource potential vary only slightly for this alternative from those for Alternative I. Thus, the level of facilities required will not change from that assumed for Alternative I. Hence, there is only a minor difference between Alternative I and Alternative V.

The potential impacts on land use from the coastal buffers are the same as described for Alternative I. There are two principal reason for this: (1) the activities that are assumed to occur under each buffer alternative essentially are the same, and (2) the mitigation potential provided by the buffers is largely duplicated by measures that are already included as part of the alternative.

CONCLUSION: The impacts of this alternative will not differ from that of Alternative I. Alternative V would alter or disrupt land use patterns in less than one-half of 1 percent of Alaska's lands. However, the alternative could alter regional land use patterns directly and indirectly impacted by pipeline and pipeline- service-road construction for over 20 years.

(c) Transportation Networks

The reduction of resources accomplished by this alternative would only slightly lessen the flow of material and people on transportation systems serving the Arctic and would not change the number or type of emplaced petroleum-related facilities from those expected for Alternative I. In the Chukchi, Beaufort, and Bering Seas and the Gulf of Alaska, basic production infrastructure such as support bases, airstrips, pipelines, pump stations, and service roads would be emplaced and the level of use and size of these facilities serving the affected areas would not be appreciably reduced from that of Alternative I. Passenger and material volumes on road, air, and marine systems serving OCS-related petroleum development in the Beaufort, Chukchi, and Bering Seas and the Gulf of Alaska would not appreciably fall. The resource estimates for unleased resource potential vary only slightly for this alternative from those for Alternative I. In all other areas of Alaska, the sale schedule and estimated resources do not vary from those of Alternative I. Accordingly, there should be no change in impacts on transportation systems in subarctic Alaska for this alternative from those of Alternative I, given that the scenarios for the buffer alternatives are essentially the same and that measures to protect coastal resources are already part of the proposed program.

CONCLUSION: Impacts from this alternative will be the same as for Alternative I for all areas, including the Beaufort and Chukchi Seas. Vessel and air traffic in Alaska are not expected to increase to the level at which the transportation systems are stressed.

(d) Sociocultural Systems

The impact-producing agents that could affect sociocultural systems are the same as for Alternative I, including the introduction of changes in industrial activities, changes in local population and employment, and effects on subsistence harvests and networks.

As in Alternative I, the changes in industrial activities introduced by these IPA's would be community-specific and, in most cases, would not represent the introduction of industrial activities for the first time. Most supply and support bases would be located at or near existing industrial infrastructure such as airports and harbors. Industrial enclaves are assumed to be used in areas without existing industrial infrastructure. Effects on sociocultural systems from constructing these facilities should be the same as for Alternative I. Effects of increased employment and population also would be the same as Alternative I, because the number and relative characteristics of the scenario remain similar to Alternative I.

Effects on sociocultural systems in Alaska and the contiguous U.S. from effects on subsistence harvests and networks from oil spills would be the same as Alternative I, because the only change from Alternative I in spill potentials is a reduction in Arctic pipeline spills from three to two for spills of equal to or greater than 1,000 bbl. Potential spills from platforms and tankers remain the same as Alternative I. The geography of the proposed buffers are such as to not provide measurable reductions in impacts on subsistence, with a resulting limited measurable reduction in sociocultural systems impacts.

The effects of added measures of protection also would be the same as for Alternative I, no substantive differences between the potential impacts of the coastal buffer alternative were identified.

CONCLUSION: Alternative V is expected to contribute to the increasing urbanization of the North Slope Borough, and Barrow in particular, and increase the need for wage income. Dysfunctional social effects, such as domestic violence and substance abuse, are expected to be sustained and perhaps increased. Adverse effects on subsistence, especially from oil spills, are expected to adversely affect sociocultural systems. Effects on sociocultural systems are expected to be most unsettling in areas that are least urbanized.

(3) Pacific Region

(a) Demography and Employment

The scenario for Alternative V in California assumes 6 platforms, 20 exploratory and delineation wells, and 120 development and production wells. Other scenario components, including no new onshore facilities remain the same as Alternative I. The oil spill risk from pipelines will be slightly reduced.

The reduction in the number of platforms, exploration and development wells from Alternative I will reduce the potential for offshore operations to generate employment for coastal residents. Assuming that the hypothesized platforms generate employment opportunities equally, a reduction of the total number of platforms from seven to six represents approximately an 18 percent reduction in employment opportunities. Therefore, the impact factors affecting demography and employment under Alternative V are on average 18 percent less than under Alternative I. Therefore, impacts on demography and employment would be approximately 18 percent less than Alternative I.

In summary, under Alternative V, there would be fewer platforms and exploration and development activities in the Pacific Region. Under this scenario, impacts on demography and employment are estimated to be on average 18 percent less than those identified for Alternative I (Section IV.D.1.a(10)).

CONCLUSION: Based on the scenario assumptions, Alternative V is expected to result in employment and population increases of about 18 percent less than Alternative I.

(b) Land Use

Adoption of Alternative V would result in a reduction in the number of blocks being considered for leasing in Southern California. This would result in fewer platforms and exploration and development wells. However, all routine activities and accidental events assumed to occur in the Pacific Region under Alternative I would remain the same. The risk of an oil spill from pipelines and vessel traffic would be reduced slightly.

The expected impacts on land use would be the same as under Alternative I, Section IV.D.1.a(10). No changes to land use are expected to result directly from Alternative I since no new onshore facilities are expected to be constructed. Impacts on land use from housing for new resident employees would be about 18 percent less than Alternative I.

In summary, land use impacts from routine offshore operations under Alternative V would be the same as under Alternative I, while impacts from housing for new residents would be about 18 percent less than Alternative I.

CONCLUSION: As a result of Alternative V no new onshore facilities are expected to be constructed. Therefore, no changes to land use are expected from routine oil and gas activities (same as Alternative I). However, land use impacts related to the housing needs of new residents would be about 18 percent less than Alternative I.

(c) Vessel Traffic and Ports

Adoption of Alternative V would result in a reduction in the number of blocks being considered for leasing in Southern California. This would result in fewer platforms and exploration and development wells. But all routine activities and accidental events assumed to occur in the Pacific Region under Alternative I would remain the same. The risk of an oil spill from pipelines would be reduced slightly, as would the already small risk associated with a collision between a vessel and a platform.

The expected impacts to vessel traffic and ports would be reduced slightly from Alternative I. Routine activities may adversely affect vessel traffic and ports. Pipeline installation activities are expected to cause short-term conflicts (approximately 45 days) with vessel traffic. No new pipeline landfalls are anticipated. Support-vessel traffic and survey boats will increase the need for marine traffic controls and port berthing space. Temporary impacts of up to two months to marine vessels, such as rerouting and/or preclusion from leaving port were expected as a result of the hypothesized oil spills, which included a pipeline spill in southern California and several tanker spills along the Pacific coast from tankering from Alaska.

In summary, vessel traffic and ports impacts under Alternative V would be reduced slightly from Alternative I. Routine activities such as pipeline installation and support boats may adversely impact vessel traffic and ports. Temporary impacts of up to two months during cleanup may occur from the hypothesized oil spills.

CONCLUSION: Impacts due to Alternative V are expected to be reduced slightly from Alternative I. The risk of an oil spill from pipelines and vessel traffic would be reduced slightly. Impacts from the hypothesized oil spills would remain the same as Alternative I.

(d) Public Services

The scenario for Alternative V in California assumes 6 platforms, 20 exploratory and delineation wells, and 120 development and production wells. Other scenario components, including no new onshore facilities remain the same as Alternative I. The oil spill risk from pipelines will be slightly reduced.

Water supply may be impacted by all phases of exploration, development, and production as well as from population increases related to offshore oil and gas development. Offshore water demand is commonly met by using desalination units, bottled water, and fresh water brought from shore to the rig or platform. The expected impacts from Alternative V on water supply would be reduced by about 18 percent from Alternative I, Section IV.D.1.a(10).

In summary, water supply in most of southern California is under a lot of stress due to years of drought. Any new demand for water would put more pressure on existing supplies. Water supply may be impacted by all phases of exploration, development, and production as well as from population increases related to offshore oil and gas development.

CONCLUSION: Water supply in southern California is expected to be impacted by exploration, development and production as well as from population increases related to offshore oil and gas activities from Alternative I. Impacts due to Alternative V are expected to be reduced by about 18 percent from Alternative I.

(4) Atlantic Region

(a) Demography and Employment

The reduction in the number of exploration and development wells and production platforms would reduce the potential for offshore operations to generate employment for coastal residents. However, as discussed in Section IV.D.1.a(10), the absence of an existing offshore drilling industry in the Atlantic coastal States limits the number of jobs that are expected to be available to coastal residents. This would result in the majority of workers on offshore drilling rigs and platforms coming from outside the area. Therefore, the potential impact on demography and employment from offshore drilling operations in Alternative V is the same as in Alternative I. Since the number of support bases, gas pipelines, gas processing plants in the Alternative V scenario are the same as those assumed for Alternative I, the impact of these facilities on demography and employment is expected to remain the same.

In summary, under Alternative V, exploration for oil and gas will offer few employment opportunities for coastal residents. Because of their longer period of operation, development and production of discovered resources under the scenario for Alternative V is expected to increase employment in areas surrounding permanent support bases. However, the increase in the number of jobs is not expected to add measurably to the existing economy. Increases in population as a result of

Alternative V compared to the already high growth rates of coastal counties are expected to be small.

CONCLUSION: Under Alternative V, the absence of an offshore drilling industry limits employment opportunities for local residents. There is the potential for an increase in the number of jobs available to coastal residents as a result of OCS activities under Alternative V. This increase, however, is not expected to be substantial compared to the number of jobs already available in coastal economies.

(b) Land Use

Since the number of onshore facilities remains the same for Alternative V as for Alternative I scenario, the amount of land that will be affected is expected to remain the same. Therefore, under Alternative V, there will be no change in the impacts expected from the development of onshore facilities (see Section IV.D.1.a(10)).

In summary, creation of the infrastructure assumed under Alternative V is expected to require the expansion of existing facilities and the development of undeveloped land. However, existing ports in the region can handle the acreage needs of OCS support bases, thereby avoiding discernible impacts on coastal land use. Additionally, State coastal management programs and governmental regulations and permit requirements will direct pipeline landfalls and development of gas processing facilities to appropriate areas.

CONCLUSION: Under the scenario for Alternative V, the acreage of the industrial/urban class of land use in coastal communities is expected to increase. However, areas exist within the potentially affected States that are already designated for industrial development and the possible siting of facilities related to OCS operations under this alternative.

(c) Vessel Traffic and Ports

The number of support bases assumed under Alternative V is the same as for Alternative I. Therefore, under Alternative V there will be no change from Alternative I in the impacts expected from the development of onshore facilities (see Section IV.D.1.a(10)). However, the determining factor in the amount of vessel activity at the support bases is the number of wells drilled and the timing of the drilling operations. The total number of wells drilled for Alternative V is reduced by 14 for a total of 129. These wells are assumed to be drilled between 1995 and 2006; the same length of time as Alternative I drilling program. Therefore, under Alternative V, there is expected to be a very slight reduction in vessel traffic associated with OCS operations compared to Alternative I scenario. Associated with this reduction in vessel activity is an expected reduction in the potential for conflict with commercial and recreational fishing. Additionally, the potential for small fuel spills occurring will decrease.

As discussed in Alternative I, existing traffic routing measures and safety regulations can manage the assumed drilling activity under Alternative V. Enforcement of marine safety laws and oil spill contingency plans will combine to prevent appreciable impacts from small fuel spills (see Section IV.D.1.a(10)).

CONCLUSION: Regulations enforced by the U.S. Coast Guard are adequate for the safe management of vessel traffic. Existing port facilities can accommodate volume of vessel traffic under Alternative V.

k. Impacts on Fisheries

(1) Gulf of Mexico Region

(a) Commercial Fishing

A number of routine events such as production platform emplacement may adversely affect commercial fishing. It is estimated that new offshore platforms resulting from the alternative will remove approximately 984 ha (2,460 ac) of trawling space from commercial fishing with a 30-mile buffer, representing less than 0.01 percent economic loss to the commercial fishing of shrimp and sciaenid groundfish for no more than one fishing season.

Accidental events such as underwater OCS obstructions and oil spills may adversely affect fish resources. It is assumed that 4,180 km (2,595 m) of offshore pipeline will result from the alternative. Underwater obstructions will cause a 0.01 percent or less economic loss to the commercial fishing of menhaden, shrimp, and sciaenids for no more than one fishing season. Four oil spills (greater than or equal to 1,000 bbl) from program-related activities and increased import tankering due to decreased domestic production have been described previously. It is assumed that some spilled oil will penetrate into estuaries. The small oil spills will contact and affect no more than 100 ha of estuaries and fish nurseries for less than one fishing season. Both lethal and sublethal effects on commercial fisheries resources and depression of commercial fishing activities will occur.

CONCLUSION: As a result of this alternative, a 0.01-0.1 percent economic loss to commercial fisheries of estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters is expected to occur for one to two fishing seasons. The principal cause of impacts is spilled oil, and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Recreational Fishing

This alternative will lead to the installation of new offshore gas and oil production platforms which will function as very large artificial reefs attracting sport fish and fishermen. Oil spills greater than 1,000 bbl will temporarily discourage offshore fishing and lead to a loss of fishing activity and a decline in the sale of fishing equipment, supplies and services within the coastal community impacted. The lack of fishing activity and the loss of sales of fishing equipment, supplies and services caused by oil pollution will not extend beyond the community impacted or the days or weeks it takes to clean up the spill.

CONCLUSION: The marine recreational fishing industry is expected to continue its growth and expansion in the Gulf of Mexico in direct association with continued and expanded economic growth in general, and gas and oil leasing, in particular. Many of the future offshore fishing trips in the northern Gulf will extend the focus of specific fishing efforts in direct proximity to the new gas and oil platforms expected to result from this alternative. Oil spills will disrupt fishing activities in the offshore areas directly impacted, and can lead to a decline in the sale of fishing equipment, supplies, and services for up to one fishing season when large quantities of oil pollution come ashore in a coastal fishing community. Establishing a 30-mile buffer zone along the northwest Florida coast would extend the distance from shore where platforms might be installed, extending beyond the range of many recreational fishermen residing in northwest Florida.

(2) Alaska Region

COMMERCIAL FISHING: The routine elements of the scenario that may affect commercial fishing are as follows: OCS-vessel traffic that could conflict with commercial-fishing traffic, especially in areas such as enclosed bays; wells, platforms, and offshore pipelines; and onshore marine bases that are also used by the commercial-fishing industry. The number of wells and platforms for Alternative V is the same or nearly the same as Alternative I.

Potential adverse effects on the commercial-fishing industry include: (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; (3) loss or damage to fishing vessels through collisions with oil-industry vessels; (4) competition for support services, infrastructure, materials, and labor; and (5) competition for space onshore.

Oil spills could damage the commercial fisheries by gear fouling, preemption or closure of fishing areas, direct loss of catch, and contamination or tainting of harvest. The number of spills are less for Alternative V (3) than Alternative I (4) in the Beaufort Sea and Chukchi areas (see Part C-1), but the same for the other planning areas. Impacts on water quality from oil spills, which are analyzed in the water-quality section, are used in analyzing impacts on commercial fish. The conclusion of that section is that water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for about 30 days.

None of the standard stipulations that potentially would be adopted for the five sale areas with commercial fishing would change any impacts, if adopted.

For each of the planning areas with commercial fishing, it is expected the impact of Alternative V on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear up to 5 percent and loss of secondary employment up to 5 percent resulting from (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; and/or (3) loss or damage to fishing vessels through collisions with oil-industry vessels. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor as a result of increased competition. Costs to commercial fishermen are expected to increase no more than 10 percent for space onshore as a result of increased competition. These impacts are expected to last for as many seasons as there is OCS activity.

CONCLUSION: The impacts for Alternative V are the same as for Alternative I. For each of the planning areas with commercial fishing, it is expected the impact on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear up to 5 percent and loss of secondary employment up to 5 percent. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor and no more than 10 percent for space onshore. These impacts are expected to last for as many seasons as there is OCS activity.

As a result of an oil spill, commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days, the commercial fisheries are expected to have up to a 5-percent loss of catch and up to a 5- percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil could be up to 5 percent. There is an up-to-81-percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the western coast of the U.S. over the 24- to 32-year life of the alternative.

(3) Pacific Region

(a) Commercial Fishing

Impacts on Pacific OCS Region fishery resources from both normal development and accidental causes will be the same as those described for Alternative I discussed in Section IV.D.1.a(6), except in the buffer area. Routine operations will not occur in the buffer area. Therefore, impacts associated with those activities will be eliminated. Impacts associated with routine activities throughout the remaining area include installation and operation of manmade structures, effluents and discharges from drilling discharges, and underwater noise from geophysical surveys. Impacts from these activities are expected to involve inconveniences lasting for the life of the installed platforms with little or no discernible economic loss.

The hypothesized level of development for Alternative V is reduced from Alternative I by one platform and an associated pipeline. There is a 28 percent probability of one or more oil spills of 1,000 bbl or greater occurring from production in the Southern California Planning Area. It is also assumed that no oil spill would occur in the buffer area (Figure II.E.1-9). Although oil spilled from a pipeline could move into the buffer area and contact fish populations within it, the likelihood is reduced.

Tanker traffic is unaffected by this alternative, and as a result, commercial fishing habitat throughout the planning area is at risk from a tanker spill. A large oil spill that occurs during peak season and contacts areas used by fixed gear (traps, pots) fishermen could result in high economic losses ranging up to 20 - 30 percent. The affected areas could be closed to fishing for a period of weeks to a month during the spill and clean up activities. Financial losses to economically dependent businesses, particularly in the Santa Barbara and Washington regions, could range to 10 or 20 percent. Economic effects may last up to two seasons.

CONCLUSION: Adoption of Alternative V would eliminate impacts from routine operations in the buffer area. Impacts from routine operations in the remaining areas would involve inconveniences lasting for the life of the platform of 35 years with little or no discernible economic loss. An oil spill could result in high economic losses to fixed gear fishermen ranging from 20 to 30 percent lasting for two seasons and financial losses of 10 to 20 percent of economically dependent businesses particularly in the Santa Barbara and northern Washington regions. The chance of these spill related impacts occurring in the buffer area would be reduced as the result of this alternative.

(b) Recreational Fishing

Impacts on Pacific OCS Region fishery resources from both normal development and accidental causes will be the same as those described for Alternative I discussed in Section IV.D.1.a(6), except in the buffer area. Routine operations will not occur in the buffer area. Therefore, impacts associated with those activities will be eliminated. Impacts associated with routine activities throughout the remaining area include installation and operation of manmade structures, effluents and discharges from drilling discharges, and underwater noise from geophysical surveys. Impacts from these activities are expected to involve inconveniences lasting for the life of the installed platforms with little or no discernible economic loss. While numerous, very small oil spills (usually 1 bbl) are expected to occur, they are unlikely to have any impact on recreational fishing.

The hypothesized level of development for Alternative V is reduced from Alternative I by one platform and an associated pipeline. There is a 28 percent probability of one or more oil spill of 1,000 bbl occurring from production in the Southern California Planning Area. It is also assumed that an oil spill would not occur in the buffer area (Figure II.E.1-9). Although oil spilled from a pipeline could move into the buffer area and contact fish populations within it, the likelihood is reduced.

Tanker traffic is unaffected by this alternative, and as a result, commercial fishing habitat throughout the planning area is at risk from a tanker spill. A large oil spill contacting a harbor used by sport fishermen is expected to result in local economic losses of 10 to 20 percent over a period of approximately a month, or the length of time needed for spilled oil to be cleaned up or dissipated by wind and waves. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced by Alternative I, fisheries resources available to sportfishermen will be unchanged.

CONCLUSION: Adoption of Alternative V would eliminate impacts from routine operations in the buffer area. Impacts from routine operations in the remaining areas would result in economically indiscernible minor inconveniences to marine recreational fishing activities for the life of the project. An oil spill is expected to result in local economic losses of 10 to 20 percent over a period of approximately a month, or the length of time needed for spilled oil to be cleaned up or dissipated by wind and waves. The chance of these spill related impacts occurring in the buffer area would be reduced as the result of this alternative. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced by the alternative, fisheries resources available to sportfishermen will be unchanged.

(4) Atlantic Region

(a) Commercial Fishing

If Alternative V is adopted, impacts from routine activities, including spatial conflicts and the effects of drilling discharges, in the shelf-edge fisheries off Cape Hatteras will be eliminated. Adoption of this alternative also will eliminate impacts to the benthic communities off Cape Hatteras which some investigators believe are coupled to the productivity of the overlying water masses (USDOI, MMS, 1990f). However, under this scenario, impacts to the remaining lease areas would not differ from those outlined under Alternative I (Section IV.D.1.a) because reduction in the overall level of OCS activities is accompanied by a corresponding reduction in the number of lease blocks.

The primary effect from the emplacement of trunklines and gathering lines occurs in shallow water (60 m [200 ft]) where pipelines must be buried (Section IV.D.1.a). Adoption of this alternative will not alter the expected impacts on benthic communities as outlined in Alternative I (Section IV.D.1.a).

Although no oil spill of 1,000 bbl or more is assumed under this scenario, small operational spills and 1 larger oil spill are expected to release hydrocarbons into the marine environment. However, release of hydrocarbons into the high energy environment of the open ocean is not expected to produce impacts on commercial fisheries which could be distinguished from natural variation (Section IV.D.1.a).

In the absence of special protections, impacts on areas with unique communities or biological resources could occur under this scenario. Especially vulnerable to OCS activities are the live bottom habitats of the South Atlantic (Section IV.D.1.a).

Adoption of Alternative V will defer blocks off primarily North Carolina, many of which contain commercial fisheries for shelf-edge species (Section III.D.3.b). Impacts on commercial fisheries in the remaining potential lease blocks are not expected to change relative to Alternative I. Under Alternative V, the major effect from routine OCS activities is expected to be spatial conflict on the fishing grounds. Impacts from drilling discharges and trenching for pipelines are also expected. Recovery of affected fisheries in shallow water areas will proceed rapidly (within 1 year), but more slowly (3 to 5 years) in deep water habitats. No impacts associated with the release of hydrocarbons are expected.

CONCLUSION: Changes in commercial fisheries are expected to result from routine activities. Measurable economic changes lasting more than one to two seasons are not expected, with no measurable economic changes in secondary employment.

(b) Recreational Fishing

Under Alternative V, 150 blocks, primarily along the shelf edge off North Carolina, would be deferred. Most recreational fisheries occur inshore (Section III.D.3) and impacts to these fisheries would not differ from those described under Alternative I (Section IV.D.1.a). However, because important recreational fisheries occur off Cape Hatteras (Section III.D.3), adoption of this alternative will eliminate impacts to recreational fisheries in this area. Most of these impacts are associated with spatial conflicts and the discharge of drill muds and cuttings as described in Alternative I (Section IV.D.1.a). Expected impacts for the areas still under consideration are expected to be similar to those described in Alternative I (Section IV.D.1.a).

Small operational oil spills and even a spill of 50 to 1,000 bbl are not expected to produce impacts to recreational fisheries which can be distinguished from natural variation (Section IV.D.1.a). No impacts from small operational spills or even a larger oil spill are anticipated.

CONCLUSION: Under this alternative, impacts on recreational fisheries are not expected to result in measurable economic losses lasting more than one to two seasons.

l. Impacts on Subsistence

(1) Alaska Region

The number of pipelines, pipeline landfalls, shore bases, and miles of pipelines are assumed to be the same for Alternative V as for Alternative I. Effects on subsistence from constructing these facilities should be the same as for Alternative I. Effects of increased employment and population also should be the same as Alternative I, because the number and relative characteristics of the proposed sales remain similar to Alternative I.

Effects on subsistence in Alaska and the contiguous U.S. from oil-spill events would be similar to Alternative I. There is a reduction in pipeline spills in the Arctic from three to two for spills of equal to or greater than 1,000 bbl for Part C-1 of the alternative. Potential spills from platforms and tankers remain the same as Alternative I.

The proposed Beaufort and Chukchi Sea buffers could reduce impacts on subsistence harvests if effects on subsistence resources were reduced from Alternative I. The coastal buffer in the Hope Basin could reduce impacts on subsistence for the same reason. However, the expected changes in impacts on subsistence resources if Alternative V is adopted are not likely to cause a measurable change in impacts to subsistence harvests.

In the Bering Sea, the net effect of moving proposed leasing from 9 to 12 miles offshore the Yukon Delta is the deferral of a total of nine blocks, an amount insufficient to measurably reduce impacts on subsistence resources or harvests from Alternative I. The movement of proposed leasing from 16 to 30 miles offshore St. George Island could reduce potential impacts on subsistence if the likely impacts to subsistence resources, especially fur seals, sea lions, halibut, and marine birds, were reduced by the relocation of leasing; an unlikely event considering the number of blocks remaining for leasing after the deferral is effected. This also would be the case with deferring additional blocks off Dry Bay in the Gulf of Alaska, because considerably more blocks still would be available for leasing off the coast of Yakutat and Yakutat Bay, are the primary locations for subsistence harvest.

The effects of added measures of protection also are the same as for Alternative I. Given that measures to protect coastal environmental resources are already included as part of the alternative, no substantive differences between the potential impacts of the two buffer alternatives were identified. Given that measures to protect coastal environmental resources are already included as part of the alternative, no substantive differences between the potential impacts of the two buffer alternatives were identified.

CONCLUSION: Impacts on subsistence, as a result of the adoption of Alternative V, are expected to be centered predominantly on the arctic communities of the North Slope and Northwest Arctic Borough. One or more important subsistence resources are expected to become unavailable, undesirable for use, or available only in greatly reduced numbers for one or more periods of 1 to 2 years during the life of this alternative in the Arctic. Effects on subsistence in the Gulf of Alaska include reducing the availability or accessibility of at least one important subsistence resource for a period not exceeding 1 year. Similar effects would be expected on Kodiak Island and on the Alaska Peninsula. The subsistence of Bristol Bay and Alaska Peninsula residents would be affected for at least 1 year.

(2) Pacific Region

Under Alternative V, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Consequently, impacts on subsistence resources in the Pacific Region would remain unchanged from Alternative I. Section IV.D.1.a(12) provides a discussion of potential impacts on subsistence resources in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine activities associated with the proposed action in the Pacific Region, including the construction of subsea pipelines and platforms, the drilling of exploratory and production wells, and drill rig and platform removal, will occur at least 3 miles offshore, away from intertidal gathering areas. The buffer area would extend this protection out approximately 12 miles from the Santa Maria River north to Morro Bay. No impacts to intertidal gathering areas are expected.

Three large tanker oil spills are assumed to occur in the Pacific Region and to contact the shoreline under this alternative: one off the coast of Washington, and two off southern California. In addition, a pipeline oil spill of 7,000 bbl is hypothesized for southern California. Impacts to subsistence resources from an accidental spill would vary depending upon the location and season. The greatest effects to subsistence could be expected if the spill contacted rocky intertidal areas near population centers. This could have the effect of reducing the availability or desirability of one or more important species in some local areas on the coast for up to a year. Oil spilled from the assumed pipeline accident is unlikely to affect subsistence in San Luis Obispo County since the site of such a spill will be at least 12 miles offshore if this alternative is adopted. This buffer would allow more time for containment and clean up activities to be initiated. In addition, spilled oil will be at sea for a longer period and subject to evaporation, weathering, and dispersion before it contacted intertidal gathering areas in San Luis Obispo county.

However, tanker traffic will be unaffected by this alternative and as a result, subsistence gathering areas throughout the planning area would still be at risk from a tanker spill.

CONCLUSION: Adoption of Alternative V is expected to result in temporary effects on subsistence in the Pacific Region due to accidental oil spills. Oil spilled from the assumed pipeline accident in the planning area, is unlikely to affect subsistence in San Luis Obispo County since the site of such a spill will be at least 12 miles offshore. No impacts to onshore and intertidal gathering areas from routine exploratory and development activities associated with this alternative are expected. Assuming occurrence and contact, a large oil spill that contacts an intertidal subsistence area is expected to result in a reduction in the availability or desirability of one or more subsistence resources for up to a year.

m. Impacts on Archaeological Resources

(1) Gulf of Mexico Region

HISTORIC: The greatest potential impact to an historic archaeological resource as a result of this alternative would result from a contact between an OCS offshore activity (platform installation, drilling rig emplacement, dredging, and pipeline projects) and an historic shipwreck. Adoption of this alternative will significantly reduce the number of lease blocks with a high probability for historic shipwrecks available for leasing offshore Florida.

Most other activities associated with this alternative are expected to have little to no impacts on historic archaeological resources. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. Historic cultural resources, therefore, will not be affected by these activities. Four oil spills (greater than or equal to 1,000 bbl) from program-related activities and increased import tankering due to decreased domestic production have been described previously. Considering the locations of oil pipelines and platforms offshore, and the pattern of coastal ocean currents, it is assumed that a 25,000 bbl pipeline spill would contact the eastern Texas/western

Louisiana coast. Furthermore, the impact from an oil-spill contact on an historic coastal site, such as a fort or lighthouse, would be visual due to oil contamination. These impacts would be temporary (lasting up to weeks) and reversible.

An OCS activity could contact a shipwreck because of incomplete knowledge on the location of shipwrecks in the Gulf. Such an event could result in the disturbance or destruction of unique or significant historic archaeological information. However, it is estimated that magnetometer surveys at 50 m linespacing will be 90 percent effective at locating historic shipwrecks within high probability areas. Other factors associated with this alternative are not expected to affect historic archaeological resources.

PREHISTORIC: Several impact-producing factors may threaten the prehistoric archaeological resources of the Gulf. An impact could result from a contact between an OCS activity (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) and a prehistoric site located on the continental shelf. Adoption of this alternative will significantly reduce the number of lease blocks with a high probability for prehistoric archaeological sites available for leasing offshore Florida. The archaeological surveys and archaeological clearance of sites that are required prior to an operator beginning oil and gas activities in a lease block are estimated to be 90 percent effective at identifying possible prehistoric sites. Since the survey and clearance provide a significant reduction in the potential for a damaging interaction between an impact-producing factor and a prehistoric site, there is little chance for damaging interaction between an impact producing factor and an archaeological site or resource.

Onshore development as a result of this alternative could result in the direct physical contact between new facility construction, and pipeline trenching. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. There is little to no expected impact from these factors.

Should an assumed oil spill contact a coastal prehistoric site, the potential for dating the site using radiocarbon methods could be destroyed. Oil spill cleanup operations could physically impact coastal prehistoric sites. Previously unrecorded sites could also experience an impact from oil-spill cleanup operations on beaches. Should such contact occur unique or significant archaeological information could be lost.

CONCLUSION : As a result of this alternative, it is expected that a prehistoric archaeological site containing significant but not unique information would be disturbed to an extent that the site loses at least one but not all the physical features which would yield scientific information.

(2) Alaska Region

In this alternative, a buffer of deferred tracts would be used near the coastal zone in the Chukchi and a small area of the Gulf of Alaska. No activity would occur on these tracts. Also, this would place more distance between onshore-archaeological resources and exploration and development activities and between onshore- archaeological resources and accidental events such as oil spills.

It is assumed in this alternative that there will be approximately 90 exploration and development wells and 500 development and production wells over the entire Alaskan OCS. These activities could result in impacts to archaeological resources.

A coastal buffer alternative eliminates routine impact-producing activities on the blocks in the coastal buffer. It also means there is less of a risk to archaeological resources because of the distance from exploration and development activities. As a result, there will be fewer oil spills reaching archaeological resources than in Alternative I due to additional time for weathering of the oil. Outside the areas of the coastal buffers, impacts on other Alaskan areas remain the same as Alternative I. The Chukchi Sea (Part C-1) area would be the most protected by this alternative.

The effect of added measures of protection is the same as for Alternative I.

CONCLUSION: Under Alternative V, it is expected that some impact may occur to coastal historic and prehistoric archaeological resources from accidental oil spills.

(3) Pacific Region

Although it is not possible to predict the precise numbers or types of sites that would be affected, it is expected that under this alternative a slightly less amount of significant archaeological information will be lost compared to Alternative I. If adopted, Alternative V (Part H) would eliminate approximately 24 blocks from leasing consideration in the northern Santa Maria Basin. These blocks are located three to approximately 12 miles offshore in an area from the Santa Maria River north to Morro Bay. The routine activities assumed to occur in the Pacific Region as a result of this alternative would decrease when compared to the activities expected in Alternative I since the anticipated number of platforms is reduced from seven to six. The expected number of exploratory wells is decreased by five, the number of development wells is reduced by 30, and construction activities associated with platform and pipeline installation would not occur in any of the blocks identified as part of this alternative. Consequently, archaeological resources in the proposed deferral area will not be impacted by routine oil and gas operations if this alternative is adopted.

Impacts to archaeological resources in the remaining blocks will be the same as those identified for Alternative I (Section IV.D.1.a(13)). Bottom disturbing activities, such as setting anchors, drilling wells, muds and cuttings discharges, and installation of pipelines and platforms, could adversely affect undocumented archaeological resources. Remote sensing surveys completed prior to the initiation of drilling activities could be used to avoid anomalies, including those that might be archaeological resources.

The sources, number, and magnitude of accidental spill events assumed for this alternative are the same as those assumed for Alternative I. One pipeline spill of 7,000 barrels was estimated to occur in southern California as a consequence of the proposed lease sale. Further, a total of three tanker spills (30,000 barrels each) of Alaskan oil were assumed, one spill off the coast of Washington, and two spills offshore California.

Oil spilled from the assumed pipeline accident is unlikely to affect archaeological resources in San Luis Obispo County since the site of such a spill will be at least 12 miles offshore if this alternative is adopted. The buffer established by alternative V will allow more time for containment and clean up activities to be initiated. In addition, spilled oil will be at sea for a longer period and subject to evaporation, weathering, and dispersion before it contacted the County's shoreline.

Tanker traffic will be unaffected by this alternative and as a result, shorelines throughout the planning area and the archaeological resources located there are at risk from a tanker spill.

In the event that oil from any of the estimated spills did contact the shoreline, there is a potential for archaeological resources to be disturbed or destroyed during cleanup operations. The crisis atmosphere associated with a spill clean up would likely preclude a survey to locate and protect archaeological sites in the area. In addition, temporary degradation of the viewshed of any historic or prehistoric site during a spill and the associated clean up activities could negatively affect the site's National Register eligibility. Spill clean up activities are estimated to occur over a period of a few weeks to one month. The viewshed is expected to return to its pre-spill state once clean up activities are concluded.

Submerged sites are not expected to be impacted by an oil spill unless the oil sinks and settles to the bottom, coating any artifacts that might be present. Overall, submerged sites are not expected to be impacted as a consequence of this alternative.

CONCLUSION: Routine oil and gas activities associated with Alternative V are expected to have negligible impacts on archaeological resources in the Pacific Region. Assuming a spill of 1,000 bbl or larger occurs and contacts the shoreline, the viewshed of prehistoric or historic sites would be temporarily degraded during the spill and associated clean up activities. Undocumented onshore archaeological resources could be impacted as a result of spill clean up activities. Overall, the loss of scientific information from affected archaeological resources is expected to be negligible.

(4) Atlantic Region

PREHISTORIC: Possible impacts to prehistoric sites could arise from bottom-disturbing activities. The routine activities under Alternative V for the Atlantic that could impact on these sites are the laying of pipelines inside the 30-m isobath off most of the Atlantic coast, or inside of the 18-m isobath off North Carolina and Florida where erosion would have destroyed any prehistoric resources in deeper water (USDOI, MMS, 1990f; SAI, 1981). As noted in Section IV.D.1.a(13), prior to the commencement of any of these bottom-disturbing activities, the "Protection of Archaeological Resources" stipulation will require proof that these activities will not affect prehistoric resources.

Accidents that can disturb prehistoric sites include spilled oil and clean-up activities associated with spilled oil. Under Alternative V, it is assumed that a small spill will occur in the vicinity of each of the support bases and at the mouth of Delaware Bay.

No impacts on prehistoric resources from routine activities are expected under this Alternative. Surveys required by the "Protection of Archaeological Resources" stipulation are expected to identify buried landforms with potential for prehistoric resources. Avoidance of these areas or further proof that no prehistoric resources exist, as required by the stipulation, would prevent the loss of archaeological information. If a prehistoric resource is contacted accidentally, most of the features which give it scientific integrity are expected to remain.

Small chronic spills that could occur during supply vessel refueling typically weather or are cleaned up before they have a chance to contaminate prehistoric resources. The C^{14} datable material that may be associated with these sites is expected, therefore, to not be affected by spills of this magnitude. Those sites that could be contacted by a small diesel fuel spill would be those that are already exposed to the environment and would already have been substantially altered. Cleanup of diesel fuel spills is assumed not to involve the removal of oiled sediments since diesel fuel tends to evaporate and does not leave behind tars and asphalt. Additionally, if a spill is smaller than 12 bbl, typically neither mechanical cleanup nor dispersants are used (NAS, 1989).

HISTORIC: The existing conditions of the Atlantic historic resources are described in Section IV.D.1.a(13). Routine activities that disturb the ocean floor would have the greatest potential for affecting historic resources. Any objects placed on the ocean floor, such as drilling rigs and anchors, can crush a fragile wooden shipwreck. Dredging and burial activities during pipeline laying activities can also destroy historic shipwrecks. As with prehistoric resources, the "Protection of Archaeological Resources" stipulation would require proof that any bottom-disturbing activities would not affect historic resources.

Accidents that can disturb prehistoric sites include spilled oil and clean-up activities associated with spilled oil. For Alternative V, it is assumed that a small spill will occur in the vicinity of each of the support bases and at the mouth of the Chesapeake Bay. An oil spill (1,000 bbl or more) is not assumed under Alternative V.

Surveys required by the "Protection of Archaeological Resources" stipulation are expected to identify potential shipwrecks throughout most of the OCS. It is expected that the assumed pipeline to the Charleston, SC area will pass through an area approximately 30 to 40 km (18.6 to 24.9 mi) wide, where the remains of shipwrecks would most likely be buried. Survey limitations in this area may not prevent a shipwreck being contacted. If pipeline construction were to contact a historic shipwreck, much of the valuable information could be destroyed. Given the shipwreck density near Charleston and the assumed pipeline activity, it is expected that a shipwreck would be contacted. The "chance" find clause of the stipulation is expected to preserve much of the valuable information. The preclusion of drilling activities within 50 miles of the coast is not expected to decrease the impact on historic resources below that afforded by the stipulation.

Small spills that could occur during supply vessel refueling will have little effect on historic shipwrecks and historic structures, even those in coastal areas. These small spills typically weather or are cleaned up before they have a chance to contact a sunken vessel or historic structure. Therefore, no impacts are expected from the small spills that are assumed to occur.

CONCLUSION: Activities under Alternative V are expected to result in a historic shipwreck being contacted by pipeline construction activities. Much of the valuable information is expected to be retained by compliance with the "chance" find clause of the "Protection of Archaeological Resources" stipulation. No impact is expected to occur to prehistoric resources.

n. Impacts on Recreation and Tourism

(1) Gulf of Mexico Region

Routine drilling and production in nearshore tracts within 10 miles of coastal park and recreation areas off the coast of Louisiana, Mississippi and Alabama will be visible from shore during fair weather conditions. Helicopters and boat traffic servicing offshore operations may also be seen and heard by recreational beach users and tourists. Pipeline construction across recreational beaches in Texas, Louisiana, and Mississippi or Alabama will remove 1,200-1,600 ft of beach shorefront from recreational use for 2-3 weeks while each landfall is under construction. Offshore platforms, especially those within 25 miles of shore will attract fish and fishermen. Accidents associated with drilling, production and transportation of gas and oil will cause pollution and debris on coastal beaches. Four oil spills (greater than or equal to 1,000 bbl) from program-related activities and increased import tankering due to decreased domestic production have been described previously. Oil spills of 1,000 bbl or more are expected to lead to closure of beach and park areas along the coasts of Louisiana and Texas for up to six weeks.

CONCLUSION: Alternative V is expected to result in closure (less than a full season) at a few park and recreation areas along the coast of southeast Texas during one of the 45 years of the project life as a result of major oil spills. Tourist losses associated with these closures will be local and represent less than 10 percent of projected economic gains. Platforms installed offshore as a result of this alternative, especially those within 25 miles of shore, will attract recreational fishermen and divers.

(2) Pacific Region

If adopted, Alternative V (Part H) would eliminate approximately 24 blocks from leasing consideration in the northern Santa Maria Basin. These blocks are located three to approximately 12 miles offshore in an area from the Santa Maria River north to Morro Bay. The routine activities assumed to occur in the Pacific Region as a result of this alternative would decrease when compared to the activities expected in Alternative I since the anticipated number of platforms is reduced from seven to six. The expected number of exploratory wells is decreased by five, the number of development wells is reduced by 30, and construction activities associated with platform and pipeline installation would not occur in any of the blocks identified as part of this alternative.

If adopted, this alternative would preclude oil and gas operations on all blocks within at least 12 miles of the San Luis Obispo County coast line. Consequently, recreation and tourism resources in the county will not be impacted by routine oil and gas operations.

Impacts to recreational resources in the remaining blocks will be the same as those identified for Alternative I (Section IV.D.1.a(14)). Exploratory drilling operations, installation of platforms and associated pipelines, development drilling activities, and support vessel activities may noticeably alter offshore scenery within 16 kilometers (10 miles) of the shoreline. Oil and gas operations located beyond that distance are not expected to affect local scenery since they would barely be discernable to the naked eye.

Alteration of local offshore scenery will continue until the oil and gas operation is completed. In the case of a platform visible from the shore, local scenery will be changed for the life of the platform or approximately 35 years. Exploratory drilling operations and pipeline installation operations are temporary and would affect local scenery for approximately three to five months. Recreational fishing and boating activities are not expected to experience measurable impacts if this alternative is adopted. Some fishermen may experience displacement during a period of platform and pipeline installation but this displacement will be temporary, lasting a period of weeks. Once the platform or pipeline is installed, fishing activities are expected to return to pre-project levels, and possibly increase as fishermen take advantage of the artificial reef phenomenon in which fish congregate near structures like platforms and pipelines.

The sources, number, and magnitude of accidental spill events assumed for this alternative are the same as those assumed for Alternative I. One pipeline spill of 7,000 barrels was estimated to occur in southern California as a consequence of the proposed lease sale. Further, a total of three tanker spills (30,000 barrels each) of Alaskan oil were assumed, one spill off the coast of Washington, and two spills offshore California.

Impacts to recreation and tourism resources are the same as those identified for Alternative I (Section IV.D.1.a(14). The magnitude of these impacts is dependent on numerous factors including, the season, specific area affected, aesthetic quality of the affected coast line, amount of oil contacting the shore, oil retention of the area contacted, and the effectiveness of cleanup operations.

Oil spilled from the assumed pipeline accident is less likely to affect recreation and tourism resources in San Luis Obispo County since the site of such a spill will be at least 12 miles offshore if this alternative is adopted. The buffer established by Alternative V will allow more time for containment and clean up activities to be initiated. In addition, spilled oil will be at sea for a longer period and subject to evaporation, weathering, and dispersion before it contacted the County's shoreline.

Recreation and tourism resources south of the deferral area and throughout the Santa Barbara Channel could be impacted by a pipeline spill as oil and gas activities could occur on blocks in those areas. In addition, tanker traffic will be unaffected by this alternative and as a result, shorelines throughout the planning area (including San Luis Obispo County) and the recreation and tourism resources located there are at risk from a tanker spill.

Impacts from an oil spill are expected to result in the temporary displacement of resource users, financial losses to communities that derive income from the affected resources, and the temporary degradation of aesthetic qualities of the affected area. The duration these impacts will vary depending on the factors listed above, but in general, impacts are expected to continue through completion of the clean up effort. It is estimated that a period of a few weeks to a month would be required to clean up a spill of 1,000 barrels or greater. Use of recreation and tourism resources is expected to return to pre-spill levels following completion of clean up activities.

CONCLUSION: Routine operations assumed for Alternative I are not expected to affect recreation resources. Similarly, project related effects on the tourist industry are expected to be negligible. A change in scenic quality is expected in areas where one or more platforms are installed within sight of the shoreline. Assuming occurrence and contact to the shoreline, an oil spill is expected to close recreational facilities for a period ranging from weeks to a month during clean up activities. Recreation resource users are expected to be temporarily displaced and local communities deriving income from those users are expected to experience economic loss during the clean up period.

(3) Atlantic Region

Under the Alternative V, all blocks within 50 miles of the coast will be removed from the leasing schedule. This action will eliminate the potential for visual impact on the coastal visitor from drilling operations. Because of the transitory nature of the recreational fishery, little impact on this industry from the presence of offshore drilling and production structures and their spatial exclusion zones is expected. Additionally, the Fisheries Training Program for offshore operators and notification efforts of the U.S. Coast Guard would help prevent collisions between recreational fishing vessels and drilling structures as well as fishing gear entanglement (see Section IV.D.1.a(14)).

Locating the support bases closely to already industrialized areas enhances their operating efficiency and prevents any change in access by visitors to public recreation sites (see Section IV.D.1.a(14)). A gas pipeline landfall, located in a tourist area, would result in closure of the area during construction. The acreage effect would be small and construction could be accomplished during the off-season. However, it is expected that Federal and State reviews will result in the location of landfall for the two assumed pipelines being directed away from sites that are important to the coastal recreation and tourism industry. Gas processing facilities are assumed to be built in areas of existing urban or industrial development. Therefore, access to public recreation sites would not change (see Section IV.D.1.a(14)).

CONCLUSION: Under Alternative V, no long-term changes in the opportunity of the public to use recreation areas are expected.

6. Alternative VI — Exclude Designated Bathymetric Features

Alternative VI excludes designated bathymetric features in the Gulf of Mexico and Atlantic Regions by excluding blocks considered for lease that lie within the areas listed below. Alternative VI does not change the size, timing and location of leasing activities in the Alaska or the Pacific Region. Resource estimates, associated exploration and development, and oil spill assumptions for these Regions remain the same as stated in Alternative I. Therefore, the impact analyses for the resources in the Alaska and Pacific Regions for Alternative VI are identical to Alternative I (see Section IV.D.1.a).

Alternative VI — Exclude Designated Bathymetric Features

Designated Bathymetric Features (Part A) — Western and Central Gulf of Mexico Planning Areas

Part A of Alternative VI excludes the unleased blocks of the 407 blocks that contain or are near localized bathymetric features in the Western, Central, and Eastern Gulf of Mexico Planning Areas (see Figures II.F.1-1, -2, -3, -4, -5).

or

Designated Bathymetric Features (Part B) — Mid- and South Atlantic Planning Areas

Part B of Alternative VI excludes 34 whole blocks from consideration that lie within or surround canyon head, flanks, and axes in the Mid- and South Atlantic Planning Areas (see Figure II.F.1-6).

RESOURCE ESTIMATES: Resource estimates for Alternative VI are presented in Table IV.D.6-1. Section IV.D.1.a provides a discussion on the PRESTO model used to calculate the resource estimates that are assumed to be leased, discovered and produced. These resource estimates are comparable to that of the proposal (Alternative I).

EXPLORATION AND DEVELOPMENT ASSUMPTIONS: The hypothetical scenarios concerning exploration and development activities for Alternative VI were developed using the same assumptions as for Alternative I (Section IV.D.1.a). The level of offshore and onshore activities are based on the amount of hydrocarbon resources assumed to be leased, developed, and produced as a result of sales in Alternative VI (see Table IV.D.6-2 and IV.D.6-3).

TRANSPORTATION AND MARKET ASSUMPTIONS: The amount of natural gas and oil resources assumed to be leased and developed in the Western and Central Gulf of Mexico and Mid- and South Atlantic Planning Areas are comparable to those of the proposal (Alternative I). The basic assumptions used in Alternative I concerning how gas and oil production will be transported to shore (Section IV.D.1.a) are still valid. No assumption was made concerning the amounts of natural gas and oil that would be forgone as a result of the adoption of Alternative VI.

Table IV.D.6-1. Conditional Resource Estimates — Exclude Designated Bathymetric Features

REGION AND PLANNING AREA	OIL (BBO)	GAS (TCF)	MP$_{HC}$
GULF OF MEXICO REGION			
Western Gulf of Mexico	0.23	3.51	1.00
Central Gulf of Mexico	0.57	5.64	1.00
Eastern Gulf of Mexico	0.02	0.22	1.00
ALASKA REGION			
Beaufort Sea	0.52	——	0.16
Chukchi Sea	2.01	——	0.21
Hope Basin *or*	0.24	——	<0.01
St. George Basin	0.23	——	0.02
Norton Basin *or*	0.30	——	<0.01
St. Matthew-Hall *or*	<0.01	——	<0.01
Navarin Basin	0.24	——	0.03
Cook Inlet	0.16	——	<0.01
Gulf of Alaska	0.34	——	0.04
PACIFIC REGION			
Southern California	0.33	1.01	1.00
ATLANTIC REGION			
Mid- and South Atlantic	0.08	2.24	0.63

BBO - Billion Barrels of Oil
TCF - Trillion Cubic Feet
MP$_{HC}$ - Marginal Probability of Commercial Hydrocarbons

OIL SPILL ASSUMPTIONS:

Oil Spills Greater Than or Equal to 1,000 bbl. Table IV.D.6-4 presents the number and type of oil spills assumed to occur as a result of OCS activity associated with Alternative VI. The source and number of assumed spills were based on the volume of oil listed in Table IV.D.6-1, assumptions on the mode of transportation and spill rates for spills greater than or equal to 1,000 bbl (see Section IV.D.1.a).

Table IV.D.6-5 presents the probabilities of one or more spills of 1,000 bbl or greater and 10,000 bbl or greater occurring. These probabilities are based on the total estimated mean number of spills assumed to occur as a result of oil production from the adoption of Alternative VI. It is also assumed that these spills would occur with uniform frequency over the life of the alternative.

Table IV.D.6-6 presents the assumed location of tanker spills along the tanker routes. Tanker spills resulting from production in the Beaufort and Chukchi Sea Planning Areas are assumed to occur outside of those planning areas. Oil produced in the Beaufort and Chukchi Sea Planning Areas would be transported by the TAPS to the Valdez terminal facilities and then transported by tanker to west coast ports. Based on the destination and amount of the TAPS oil shipped from Valdez to west coast ports (Puget Sound, Washington; San Francisco and Los Angeles, California), it is reasonable to assume that a tanker spill should occur along the tanker route to these ports.

Table IV.D.6-2. Exploration And Development Activity — Exclude Designated Bathymetric Features

Planning Area	Sales (No.)	BBOE	MPHC	Exp./Del. Wells (No.)	Dev./Pro. Wells (No.)	Platforms (No.)	Years Of Activity
Western Gulf of Mexico	5	.86	1.00	1000	540	50	1993-2031
Central Gulf of Mexico	5	1.58	1.00	1380	980	110	1994-2031
Eastern Gulf of Mexico	2	.05	1.00	90	40	8	1998-2036
Beaufort Sea	2	.52	0.16	12	70	3	1994-2021
Chukchi Sea	2	2.01	0.21	47	268	7	1995-2025
Hope Basin *or*	1	.24	<0.01	8	34	1	1996-2021
St. George Basin	1	.23	0.02	8	50	1	1996-2021
Norton Basin *or*	1	.30	<0.01	11	66	1	1997-2022
St. Matthew-Hall *or*	1	<.01	<0.01	6	—	—	1997-1999
Navarin Basin	1	.24	0.03	8	48	1	1997-2022
Cook Inlet	1	.16	<0.01	6	26	1	1995-2019
Gulf of Alaska	1	.34	0.04	11	53	1	1996-2021
Southern California	1	.51	1.00	25	150	7	1998-2030
Mid- and South Atlantic	2	.48	0.63	35	108	6	1995-2024

MPHC - Marginal Probabilty Of Commercial Hydrocarbons
BBOE - Billion Barrels of Oil Equivalent

The probabilities of one or more pipeline or platform spills equal to or greater than 1,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 46 percent and 92 percent, respectively. The probabilities of one or more pipeline or platform spills equal to or greater than 10,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 19 percent and 57 percent, respectively. As a result of the transportation of oil from the Chukchi Sea Planning Area, there is a 93-percent probability of one or more spills of 1,000 bbl occurring and a 81-percent probability of one or more spills of 10,000 bbl or greater occurring. As a result of the transportation of oil from the Beaufort Sea Planning Area, there is a 46-percent probability of one or more spills occurring and a 36-percent probability of one or more spills of 10,000 bbl or greater occurring.

Oil Spills Greater Than 1 bbl and Less Than 1,000 bbl. Table IV.D.6-7 presents the estimated mean number of small spills assumed to occur as a result of the adoption of Alternative VI. Section IV.D.1.a presents the assumptions used in the calculation of small spills.

Table IV.D.6-3. New Offshore and Onshore Infrastructure — Exclude Designated Bathymetric Features

Planning Area	Platforms (No.)	Oil and Gas Pipelines[3,6,7,8] (No.)	Oil and Gas Pipelines [7,9] (Miles)	Pipeline Landfalls (No.)	Shore Bases/ Support Facilities (No.)
Western Gulf of Mexico	50	–	1020	2	2[1]
Central Gulf of Mexico	110	–	1240	2	2[2]
Eastern Gulf of Mexico	8	–	445	–	–
Beaufort Sea	3	–[4]	275	1	1[5]
Chukchi Sea	7	–[4]	250	1	1[5]
Hope Basin *or*	1	1	90	1	1[5]
St. George Basin	1	–	–	–	1[5]
Norton Basin or	1	–	–	–	–[5]
St. Matthew-Hall *or*	–	–	–	–	1
Navarin Basin	1	–	–	–	–
Cook Inlet	1	1	25	1	1[5]
Gulf of Alaska	1	1	100	1	1[5]
Southern California	7	14	50	–	–
Mid- and South Atlantic	6	3	580	3	6[10]

1. Gulf of Mexico Region - additional support facilities: 2 new marine terminals.
2. Gulf of Mexico Region - additional support facilities: 1 new marine terminal and 1 new pipeline yard.
3. Alaska Region - oil pipelines only.
4. Alaska Region - offshore gathering system.
5. Shorebases can include tank farms, docks, air bases, utilities, supply depots and personnel quarters.
6. Pacific Region - total number of oil and gas pipelines.
7. Pacific and Gulf of Mexico Regions - oil and gas pipelines are layed along the same pipeline corridor.
8. Atlantic Region - gas pipelines only.
9. Atlantic Region - total pipeline miles includes gathering and trunk lines.
10. Atlantic Region - additional support facilities: 2 new gas plants, and 2 new heliports, 2 supply bases.

Table IV.D.6-4. Oil Spill Assumptions — Exclude Designated Bathymetric Features

Planning Area	Assumed Oil Spills[3] Platform (Nos.)	Pipeline (Nos.)	Tanker (Nos.)
Western Gulf of Mexico	–	1	–
Central Gulf of Mexico	1	1	–
Eastern Gulf of Mexico[1]	–	–	–
Beaufort Sea	–	1	1
Chukchi Sea	1	2	3
Hope Basin *or*	–	–	1
St. George Basin	–	–	1
Norton Basin *or*	–	–	1
St. Matthew-Hall[2] *or*	–	–	–
Navarin Basin	–	–	1
Cook Inlet	–	–	1
Gulf of Alaska	–	–	1
Southern California	–	1	–
Mid-and South Atlantic[1]	–	–	–

1. No spill was assumed — total estimated mean number of spills was 0.14 - Mid- and South Atlantic and 0.03 Eastern Gulf of Mexio.
2. No spill was assumed — exploration activity only.
3. Based on the total estimated mean number of spills greater than or equal to 1,000 bbl.

Table IV.D.6-5. Oil Spill Probabilities — Exclude Designated Bathymetric Features

Planning Area	Oil (BBO)	MP_{HC}	Probability of 1 or more spills occurring 1,000 bbl or greater	 10,000 bbl or greater
Western Gulf of Mexico	0.23	1.00	28%	10%
Central Gulf of Mexico	0.57	1.00	52%	22%
Eastern Gulf of Mexico	0.02	1.00	3%	< 1%
Beaufort Sea	0.52	0.16	73%	48%
Chukchi Sea	2.01	0.21	**%	96%
Hope Basin *or*	0.24	<0.01	47%	27%
St. George Basin	0.23	0.02	34%	21%
Norton Basin *or*	0.30	<0.01	41%	25%
St. Matthew-Hall *or*	<0.01	<0.01	—	—
Navarin Basin	0.24	0.03	34%	21%
Cook Inlet	0.16	<0.01	34%	18%
Gulf of Alaska	0.34	0.04	59%	34%
Southern California	0.33	1.00	34%	14%
Mid-and South Atlantic	0.08	0.63	13%	7%

**probability of one or more spills occurring is greater than 99.5%

BBO - Billion Barrels of Oil

1. No spill was assumed — total estimated mean number of spills was less than .33.
2. No spill was assumed — exploration activity only.
3. Based on the total estimated mean number of spills greater than or equal to 1,000 bbl.

Table IV.D.6-6. Oil Spill Assumptions —Exclude Designated Bathymetric Features Assumed Location of Tanker Spills

Location of the Tanker Spill Planning Area	Assumed Tanker Spills (Nos.)
Hope Basin *or*	1
St. George Basin	1
Norton Basin *or*	1
Navarin Basin	1
Cook Inlet	1
Gulf of Alaska	2
Washington and Oregon	3
Northern California	1
Southern California	1

Table IV.D.6-7. Small Spill Assumptions — Exclude Designated Bathymetric Features

Planning Area	Assumed Small Spills >1≤50 bbl[1]	Assumed Small Spills >50<1,000 bbl[2]
Western Gulf of Mexico	31	1
Central Gulf of Mexico	77	3
Eastern Gulf of Mexico	3	–
Beaufort Sea	132	5
Chukchi Sea	515	21
Hope Basin *or*	61	2
St. George Basin	58	2
Norton Basin *or*	76	3
St. Matthew-Hall *or*	–	–
Navarin Basin	61	2
Cook Inlet	41	2
Gulf of Alaska	86	3
Southern California	24	1
Mid-and South Atlantic	20	1

Small Spills Rates per billion bbls of oil produced:

1. Gulf of Mexico Region - 135; Alaska and Atlantic Regions - 253.63; Pacific Region - 72.65
2. Gulf of Mexico Region - 5 ; Alaska and Atlantic Regions - 10.25; Pacific Region - 2.14

a. Impacts on Water Quality

(1) Gulf of Mexico Region

Immediate effects would be brought about by increased drilling, construction and pipelaying activities, causing an increase in water column turbidities (lasting for several hours with mud discharges to several weeks with dredging-pipeline activities) to the affected offshore waters. The magnitude and extent of turbidity increases would depend on the hydrographic parameters of the area, nature and duration of the activity and bottom-material size and composition. Offshore Texas would receive the greatest portion of program-related pipeline burial activities, whereas, offshore Louisiana would receive the largest amounts of program-related operational discharges. Because of the continuous nature of oil and gas activities in the northwestern and northcentral Gulf of Mexico, the frequency of drilling mud and cutting and produced water discharges is judged to occur nearly continuously throughout these areas. Proposed produced water discharges (approximately 1.7 million bbl) will be rapidly diluted offshore within the immediate vicinity of the discharge source. Another 218 million bbl of produced water will be transported ashore for separation, treatment, and disposal. Significant increases in water concentrations of dissolved and particulate hydrocarbons and trace metals are not expected outside the initial mixing zone or immediate vicinity of the discharge source. Higher concentrations of trace metals, salinity, temperature, organic compounds, and radionuclides, and lower dissolved oxygen may be present near the discharge source. Long-term effects to water column processes, consisting of localized increases in particulate metal and soluble lower molecular weight hydrocarbons (e.g., benzene, toluene, and xylenes) concentrations, may be implicated within the mixing zone of the discharge. Trace metals and hydrocarbons associated with the discharge may be deposited within sediments near the discharge point. The proposed discharge of about 22.25 million bbl of drilling fluids and 6.55 million bbl of drill cuttings would encounter rapid dispersion in marine waters. Discharge plumes will be diluted to background levels within a period of several hours and/or within several hundred meters of the discharge source. The accumulation of toxic trace metals and hydrocarbons in exposed shelf waters, due to periodic releases of water-based generic muds and cuttings, are unlikely and the long-term degradation of the water column from such discharges are not major concerns. Eighteen percent or 5 million bbl of drilling fluids (muds) would be transported onshore for disposal.

One oil spill greater than or equal to 1,000 bbl is assumed to contact along a stretch of coast extending from western Louisiana to eastern Texas. Booming would serve to preclude impacts to estuarine waters there. No oil spills greater than 50 bbl and less than 1,000 bbl are expected to impact coastal and nearshore waters. However, several spills (greater than one and less than or equal to 50 bbl) are likely to result from OCS program-related activities both in the coastal zone and from offshore. Few of these offshore spills will contact the Gulf's coastline. Program-related spills will introduce oil into nearshore waters, creating elevated hydrocarbon levels (up to 100+ug/l) within affected waters. Much of the oil will be dispersed throughout the water column over several days to weeks. In shallow areas, oil may become entrained in suspended particles and bottom sediments. Water uses would be affected for up to several weeks from proposed spills and then only near the source of slick.

CONCLUSION: As a result of this alternative, an identifiable change to the ambient concentration of one or more water quality parameters will be evident up to several hundred meters from the source and for a period lasting up to several weeks in duration in marine and coastal waters. In poorly flushed coastal waterbodies, localized increases in trace metal and hydrocarbon concentrations may be severe and persist for months or longer. Chronic, low level pollution related to the proposal will occur throughout the 45-year life of the proposal.

(2) Atlantic Region

Water quality impacts resulting from routine OCS activities are described in Alternative I, where it was concluded that offshore water quality parameters would only be affected in the immediate vicinity of discharges and would return to background values within a few hours after discharges cease. Activities at onshore support bases were also determined to have no significant effects on inshore water quality. In the scenario for Alternative VI, which is described in this section, OCS leasing will not be considered on blocks that include submarine canyons. This eliminates potential impacts on water quality from activities at 34 lease blocks in the mid-Atlantic between Long Island and the Chesapeake Bay.

Causes of impacts on water quality resulting from routine onshore and offshore OCS activities are described in Alternative I (Section IV.D.1.a(1)). These causes include activities at onshore support facilities, gas processing plants, and offshore wells and platforms. Other activities affecting inshore water quality include discharges from offshore support vessels while in coastal waters, construction of gas pipelines, and channel dredging. The discharges of drilling muds and cuttings, formation waters, domestic and sanitary wastes, and sediment disturbance associated with deploying and construction of offshore platforms are the primary causes of water pollution offshore.

The effects on water quality from the discharge of drilling muds and cuttings are controlled by depth of discharge, composition of drilling muds, and the amount of muds discharged (Tables IV.A-5 and IV.A-6). The stage of drilling is the most significant factor determining these discharge parameters.

Operational oil spills are a major cause of temporary and local reduced water quality in inshore waters. The principal factors affecting water quality from oil spills are discussed in Alternative I (Section IV.D.1.a(1)). These factors include type of oil and location of spills. The more volatile hydrocarbons are likely to have the greatest effects on water quality. But the persistence of oil in the marine environment and, therefore, the prolongation of impacts on water quality is greater for less volatile hydrocarbons. The persistence of oil in the marine environment also depends on sea and air temperature, ocean currents, and turbulence.

The potential impacts on water quality from routine inshore and offshore OCS activities are discussed in Alternative I (Section IV.D.1.a(1)). Attributes of water quality that are likely to be affected by routine discharges include DO, COD, BOD, turbidity, trace metals (including heavy metals), nutrients, salinity, radionuclides, and toxic chemicals.

Effects of routine discharges on water quality on the OCS are expected within the immediate vicinity of the discharge (1,000 m [3,280 ft]) and are likely to persist for a few hours or less. The impact of discharges on water quality will be minor because of the USEPA's NPDES limitations on domestic, sanitary, and drilling discharges, the rapid dilution and dispersion of discharges in the marine environment, and the relatively low toxicity of allowable discharges.

The impact on water quality from the discharge of drilling muds and cuttings are discussed in the proposal (see Section IV.D.1.a(1)). The USEPA, through the NPDES regulations of the Clean Water Act, requires the use of drilling muds that have been tested and approved, and prohibits the discharge of drilling muds and cuttings containing visible oil. The magnitude of currents and turbulence in the water column determines the rate at which drilling muds disperse and their effect on water quality.

The effects on water quality from the discharge of formation waters are discussed in Alternative I (Section IV.D.1.a(1)). Formation waters dilute rapidly in seawater and their effect on water quality is limited to the immediate vicinity of the discharge site. In addition, the USEPA's NPDES regulations prohibit the discharge of formation water if it contains visible oil.

The impact of domestic and sanitary wastes on water quality are discussed in the Alternative I (Section IV.D.1.a(1)). Effects of these waste discharges on water quality will be restricted to the immediate vicinity of the discharge site and are likely to persist a few hours or less. As with formation waters, the discharge of such wastes offshore are regulated by the USEPA's NPDES permit system.

Inshore and offshore construction are likely to temporarily affect water quality by increasing turbidity. Effects of turbidity on inshore water quality were described in Alternative I (Section IV.D.1.a(1)). Burying of gas pipelines are expected to generate turbidity and possible release of heavy metals from sediments. The effects of increased turbidity on water quality are likely to last a few hours to a few days, depending on circulation and sediment composition within the estuary.

Accidental discharges of small oil spills are likely to have a significant impact on localized water quality. Since most small oil spills consist of fuel oil and are therefore highly volatile, small oil spills are likely to affect water quality for a few hours to days, depending on size of spill, volume of estuary, and tidal exchange. However, because of the high toxicity of fuel oil, these spills are likely to have a measurable, but short-term (few days) impact on water quality. Factors such as turbulence and the amount and type of suspended sediment can extend the impact of fuel oil spills on water quality from days to months.

The impact of routine OCS discharges in the mid- and south Atlantic are not likely to seriously affect onshore or offshore water quality. The most severe effects on water quality are expected in the immediate vicinity of the discharge site and would persist for not more than a few hours. More significant impacts on water quality are likely from fuel oil spills.

CONCLUSION: Water pollution from routine OCS gas and oil activities under the scenario for Alternative VI will not seriously degrade water quality onshore or offshore. Some water quality parameters, including turbidity and hydrocarbons, are likely to be locally elevated one or two orders of magnitude for a few days or less.

b. Impacts on Air Quality

(1) Gulf of Mexico Region

Under this alternative, emissions of the five primary pollutants will be equal to those estimated for Alternative I. Emissions from OCS offshore activities in the northwestern and northcentral Gulf represent approximately 96 percent of the total emissions estimated; whereas those for offshore Florida represent approximately 4 percent of this number. Selection of this alternative would not reduce emissions estimated for the offshore Gulf of Mexico under Alternative I. Emissions will be greatest in the northwestern and northcentral Gulf based on OCS development trends. Total emissions of the five primary pollutants from proposed new wells, platforms, and vessels ranges from 23,647 to 334,765 metric tons of the proposed 45-year life of the program. Total emissions estimated from proposed new wells, platforms, and vessels in the Gulf indicates that wells will contribute mostly NO_x, platforms mostly NO_x, CO, and VOC, and vessels will contribute all pollutants. During the early years of Alternative I, emissions would be small and increase over time as production increases. After reaching a maximum, emissions decrease rapidly to zero as the proposed action scenario assumes all platforms and wells will be removed and service vessels trips no longer needed.

For spills greater than or equal to 1,000 bbl, emissions are of order 285 tons/hour or smaller. Concentrations reaching onshore areas from these spills would be on the same level as before based on the dispersion, limited input of pollutants to the atmosphere, and transport regime present. The emissions from the oil spills will last until all the volatile compounds are evaporated, and this takes about three days. About 4 percent of OCS crude-oil production is offloaded from surface vessels at ports off Texas and the northern coast of the Gulf. Off Florida there would be 25 percent of the OCS production to be offloaded from surface vessels. The unintentional emissions from these offloading operations are unknown, but are estimated to be negligible (von Bodungen, pers. comm., 1988) in the northern coast of the Gulf. Off Florida, emissions from offloading crude would be negligible because estimated crude oil production in this area will be small.

CONCLUSION: Emissions of pollutants into the atmosphere from the activities associated with this alternative are likely to have concentrations that would not change onshore air quality classifications because of the prevailing atmospheric conditions and emissions height. Onshore concentrations of air pollutants from the proposed program-related emissions are estimated to be near 1 ug/m^3 (annual average) because the atmospheric regime, the emissions, and distance of these emissions from the coastline. Based an the above reasons and propositions, the air quality status in the Gulf of Mexico will not change because the emissions from proposed activities.

(2) Atlantic Region

The expected impacts on air quality resulting from routine OCS activities are described in the proposal (see Section IV.D.1.a(2)). It was concluded in the proposal that onshore air quality will be unaffected by routine OCS activities. Offshore air quality will be affected in the immediate vicinity of the emissions but only during the actual time period of those emissions. In the scenario for Alternative VI, which is described in this section, OCS leasing will be prohibited in lease blocks that include submarine canyons. This eliminates potential impacts on air quality from activities at 34 lease blocks in the mid-Atlantic between Long Island and the Chesapeake Bay.

The causes of impacts on air quality due to routine OCS activities are described in Alternative I (Section IV.D.1.a(2)). Air polluting emissions from these activities will occur both offshore and onshore. The types and amounts of emissions released offshore is determined by the type of equipment used and, therefore, the stage of well drilling. The kind of hydrocarbon discovery (gas, oil, or both) and the rate of hydrocarbon production also affects the type of offshore emissions. Combustion of diesel fuel by support vessels and drillships, and the combustion of natural gas by turbines on OCS development/production platforms are the principal causes of routine emissions onshore and offshore. Potential air pollutants released during onshore and offshore OCS activities include VOC, NO_x, SO_x, CO, and TSP. Tables IV.A-2, IV.A-3, and IV.A-4 lists potential types and amounts of onshore and offshore emissions. In addition, H_2S may also be released during gas flaring, well testing, and gas processing.

A discussion of the potential impacts on air quality from routine emissions offshore are included in Alternative I (Section IV.D.1.a(2)). The impact of routine emissions on offshore air quality will be restricted to the immediate vicinity of the emissions and will dissipate rapidly after emissions cease due to prevailing offshore winds. It is not likely that onshore air quality will be affected by anticipated activities at OCS drilling sites.

Onshore emission effects on air quality under the scenario for Alternative VI are expected to be the same as the effects on air quality described in Alternative I (Section IV.D.1.a(2)). No changes will occur in the number of support bases, gas processing plants, and oil refineries. Pollution generated at onshore staging sites will be similar to pollution emissions from equipment currently being used at commercial ports that are likely staging sites for offshore activities. Other onshore pollution will occur at gas processing plants and oil refineries. Potential air pollutants from these onshore sources include VOC, TSP, and H_2S. The actual effect of these pollution emissions on air quality will be controlled by NAAQS standards, and State and local air quality regulations.

Impacts on air quality from small operational oil spills are described in Alternative I (Section IV.D.1.a(2)). Air quality will be adversely affected by small inshore oil spills. However, because small operational oil spills are likely to be fuel spills which dissipate rapidly, the duration of their impact on air quality will be no more than a few days, depending on the size and location of the spill. Onshore air quality will not be affected by offshore fuel oil spills. Prevailing offshore winds will cause rapid dissipation of the spill with no subsequent effects on onshore air quality.

Gas blowouts on the OCS are also likely to reduce air quality as a result of the release of H_2S as well as VOC. These gases, however, are not expected to affect onshore air quality because of prevailing offshore winds. Gas blowouts from wells or drilling platforms, however, are unlikely due to safety requirements by the MMS.

The effects of routine OCS development in the mid- and south Atlantic under the scenario for Alternative VI are unlikely to measurably impact air quality. Effects are likely to differ little from the effects on onshore and offshore air quality described in Alternative I. The greatest effects on onshore air quality are expected to result from accidental fuel spills.

CONCLUSION: The emission of air pollutants from OCS gas and oil development under the scenario for Alternative VI will not significantly degrade air quality onshore or offshore. Some air quality parameters (such as, NO_x, SO_x, CO, VOC, and TSP) are expected to be locally elevated one or two orders of magnitude for a few days or less during offshore or onshore emissions.

c. Impacts on Marine Mammals

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect endangered and threatened cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to endangered and threatened cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb endangered and threatened cetaceans because of industry's compliance with MMS notices and adherence to FAA recommended minimum ceilings. The effects on endangered and threatened cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on endangered and threatened cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on endangered and threatened cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect endangered and threatened cetaceans. The effect on endangered and threatened cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths affected by spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: As a result of this alternative, there will be no discernible decline in an endangered or threatened cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Nonendangered Species

A number of routine events such as operational discharges, helicopter and service-vessel noise, platform noise, explosive platform removals, and seismic surveys may adversely affect cetaceans. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of a cetacean to visually or acoustically locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. It is estimated that offshore operational discharges are not lethal to cetaceans and do not affect cetacean food sources due to rapid dilution and dispersion. It is expected that OCS offshore flights will not disturb cetaceans because of notices by MMS and adherence to FAA recommended minimum ceilings. The effects on cetaceans from service-vessel and platform noise is expected to be limited to within 15 m of the source, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on cetaceans within 50 m of a detonation of a short-term nature lasting less than one week. No deaths are expected due to the MMS guidelines for explosive removals (USDOI, MMS, 1990e, appendix B). It is expected that effects from seismic surveys on cetaceans within 30 m of detonation will be sublethal lasting less than one day.

Accidental events such as oil spills may adversely affect cetaceans. The effect on cetaceans from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths from spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a cetacean population, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Atlantic Region

(a) Threatened or Endangered Species

1) Cetaceans

Potential impact producing factors associated with routine OCS gas and oil activities include noise, vessel and aircraft traffic, geophysical surveys, muds and cuttings discharges, and pipeline installation. Other than accidental collisions between support vessels or tankers and whales, routine potential impact-producing factors are considered to be sublethal in character. Although some activities associated with the proposed action are short-term in nature, others are likely to continue for the approximate 30-year life of this scenario. Discussion of routine potential impact-producing factors are give in Sections IV.A and IV.D.1.a(3).

Accidental impacts assumed for Alternative VI involve the discharge of oil or other hydrocarbons. The number of chronic operational discharges (>1 to 50 bbl) assumed is 20. One small spill (>50 to <1,000 bbl) is also assumed. The majority of chronic discharges and the 1 small spill are assumed to occur offshore. No oil spills (1,000 bbl or more) are assumed.

Special protections will insure that endangered and threatened cetacean populations are safeguarded from adverse impacts. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriate actions to determine the extent and the level of impact expected. These actions may result in modification of activities associated with exploration an development plans.

In terms of infrastructure and levels of activity under this alternative are equivalent to the proposal (Section IV.D.1.a(3)). There are 35 exploration/delineation wells and 108 development/production wells. Six platforms will be placed offshore and these will be serviced by vessels and aircraft from 2 supply bases and 2 heliports. Recovered natural gas will be transported by 3 pipelines with 3 separate landfalls. Any recovered oil will be brought to shore by tanker. Recovered gas will be processed at 2 plants onshore.

Noise is the most substantive non-lethal impact source and may result in highly site-specific habitat avoidance within the vicinity of platforms. Geophysical surveys and vessel and aircraft traffic are expected to produce noise levels which will result in temporary and short-term avoidance responses among affected individuals. Such impacts are not expected to result in measurable impacts to endangered whale populations. No whales are expected to be affected by collisions with OCS gas and oil support vessels. If a collision occurred, it could be fatal or severely debilitating. With the exception of the right whale, it is not expected that the death of a very few whales would measurably affect cetacean populations on the Atlantic OCS. The discharge of drill muds and cuttings, because of their low toxicity, rapid dispersal, and the limited expectation for exposure of whales to these materials, are not expected to result in measurable impacts to endangered cetacean populations. As identified earlier, the species most likely to be exposed to offshore gas and oil activities conducted on the shelf edge is the sperm whale. Pipeline construction is not expected to affect the population size, distribution or behavior of endangered whale populations.

Accidental discharges of hydrocarbons due to chronic discharges or a small oil spill are not expected to measurably affect endangered cetacean populations (see Sections IV.A and IV.D.1.a(3)). Oil does not adhere to cetacean skin and therefore does not affect buoyancy or thermal insulation. Contact with oil or refined hydrocarbons may result in reversible skin and soft tissue irritation. However, such impacts are short-term and non-lethal and not expected to alter the normal distribution or behavior of cetaceans on other than a short-term and localized basis. No change in population size is expected due to accidental discharges of hydrocarbons.

The deferral of canyon head areas would involve a total of 34 blocks distributed over Block, Hudson, Toms, Carteret, Lindenkohl, Spenser, Baltimore, and Accomac canyons. Deferral of these blocks could result in a slight reduction in the potential for routine OCS gas and oil impact-producing factors to affect endangered cetaceans. The sperm whale, a shelf edge species also associated with canyon habitat, would be the cetacean most likely to accrue benefits due from a decision to adopt Alternative VI. However, such benefits would be slight at the population level and unlikely to alter the expected level of impacts identified for Alternative I. Likewise, fin whales, while occurring year-round on shelf waters adjacent to canyon head areas are not a shelf edge species and a decision to adopt Alternative VI would confer only a negligible reduction in routine impact potentials for this species. The right whale and humpback whale are seasonal coastal migrants in waters of the mid-Atlantic north of Cape Hatteras. It is not expected that these two species would be affected by adoption of Alternative VI. Because of the slight benefits which could accrue to endangered cetaceans collectively from the adoption of Alternative VI, no measurable changes would be expected for this scenario which would differ substantially from the impacts described for Alternative I.

Even in the absence of special protections, no measurable impacts on endangered and threatened cetacean populations are expected.

CONCLUSION: No measurable effects on endangered cetacean populations are expected from routine OCS gas and oil operations or accidents under Alternative VI.

2) Sirenians

For information concerning the particulars of infrastructure, hydrocarbon reserves, activity levels, and other aspects of the Alternative VI scenario, see the preceding discussion on endangered and threatened cetaceans.

Discussion of routine potential impact-producing factors associated with OCS activities are given in Sections IV.A and IV.D.1.a(3). For the most part, these do not apply to the West Indian manatee population due to this species' principal distribution within Florida waters and the preference of these animals for inshore and riverine habitat.

Because the geographical distribution of the West Indian manatee does not include coastal or offshore waters at the latitudes of the potential canyon head block deferrals, it is not expected that the adoption of Alternative VI would reduce any of the impacts on the species' population size, distribution, or behavior from routine activities.

Accidental impacts which are given in the scenario description for Alternative VI apply also to sirenians. The habitat preferences and geographical distribution of this species make it unlikely that the manatee population would be measurably affected by offshore chronic operational discharges and a single small spill. The expected effects of contact between a few migratory individuals and spilled oil is described in Section IV.D.1.a(3). No measurable impacts to the West Indian manatee population are expected from accidental hydrocarbon discharges.

Even in the absence of special protections it is not expected that measurable impacts to the West Indian manatee population would occur.

CONCLUSION: Adoption of Alternative VI is not expected to result in measurable impacts on the West Indian manatee population size, behavior, or distribution.

(b) Nonendangered Species

CETACEANS: For information concerning the description of Alternative VI infrastructure, activity levels, and duration, see the preceding discussions.

Potential impact-producing factors associated with routine OCS gas and oil activities which could impact nonendangered and nonthreatened cetaceans if Alternative VI were to be adopted are very similar to alternative I and include noise, vessel and aircraft traffic, geophysical surveys, muds and cuttings discharges, and pipeline installation. Discussion and analysis of potential routine impact-producing factors expected are given in Sections IV.A and IV.D.1.a(3). Potential impacts are summarized below.

The most prominent potential impact-producing factor due to routine OCS gas and oil activities is noise. Underwater noise levels could result in limited short-term avoidance responses among certain species of cetacean. Specific noise sources which may be avoided are platform sites due to drilling activities and vessel maneuvering. Certain species such as goosebeak whales and pilot whales tend to avoid vessel traffic and would also likely avoid platform sites. Others nonendangered and nonthreatened cetaceans such as bottlenose and common dolphins are apparently not bothered by the presence of industrial activities and will even actively seek out vessels in order to ride the bow wave. It is likely that geophysical surveys will result in minor and short-term avoidance behavior by nonendangered and nonthreatened whales due to airgun discharges. A similar reaction may be expected by cetaceans startled by low flying aircraft or by sudden shifts in sound levels due to vessel and aircraft maneuvering. As with endangered cetaceans, mud and cuttings discharges are not expected to measurably impact nonendangered and nonthreatened whale populations. Pipeline construction may result in temporary habitat avoidance among species which are shy of industrial activities. Such activities are more likely to affect cetaceans occurring offshore rather than inshore species such as the bottlenose dolphin. In summary, no measurable impacts on the population size, distribution, or behavior of nonendangered and nonthreatened cetaceans are expected as a result of OCS activities.

Accidental events under Alternative VI have been described previously. The potential impacts of spilled hydrocarbons are discussed in Section IV.D.1.a(3). Nonendangered and nonthreatened cetaceans are relatively unaffected by spilled oil. Cetacean skin does not retain oil nor does contact with oil affect buoyancy or thermoregulation. Contact with spilled hydrocarbons may result in short-term and reversible inflammation of soft tissues. However, the ability of bottlenose dolphins to detect spilled oil visually and through the use of echolocation makes it likely that this particular cetacean and related delphinid species will be able to avoid spilled hydrocarbons from chronic operational discharges and the assumed single small spill. No measurable impacts due to spilled hydrocarbons are expected to affect population size, distribution, or behavior of nonendangered and nonthreatened cetaceans from Alternative VI.

Special protections will insure that nonendangered and nonthreatened cetacean populations are safeguarded from adverse impacts. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriate actions to determine the extent of the affected resource and the level of impact expected. These actions may result in modification of activities associated with exploration and development plans .

A deferral of canyon head blocks may result in a slight reduction of potential routine OCS gas and oil impacts and accidents to nonendangered and nonthreatened cetacean species which occur in deep water associated with shelf edge habitat and associated features including canyon areas. However, considering the mobility of these species and other factors such as the relative abundance of certain species in offshore areas of the mid- and south Atlantic OCS, the degree of benefit which may accompany the adoption of Alternative VI would not be expected to alter the impact analysis conclusion developed for Alternative I.

Even in the event that special protections were not in place, no measurably change in impact level on nonendangered and nonthreatened cetaceans is expected.

CONCLUSION: Under Alternative VI, no measurable impact on population size, distribution, or behavior of nonendangered and nonthreatened cetaceans is expected as a result of routine OCS gas and oil operations or accidents.

d. Impacts on Terrestrial Mammals

GULF OF MEXICO REGION: Alabama, Choctawhatchee, and Perdido Key Beach Mice. Accidental events such as oil spills and oil spill response activities may adversely impact Alabama, Choctawhatchee, and Perdido Key beach mice. It is assumed that one spill of 1,000 bbl or more will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is expected that oil spills of any size class resulting from the proposal will not contact or affect Alabama, Choctawhatchee, and Perdido Key beach mice or their habitat due to their limited home range.

CONCLUSION: As a result of this alternative, no adverse effects to Alabama, Choctawhatchee, and Perdido Key beach mice are expected to occur.

e. Impacts on Marine and Coastal Birds

(1) Gulf of Mexico Region

(a) Threatened or Endangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect endangered and threatened birds. It is expected that OCS offshore flights will not disturb endangered and threatened birds because of prohibitions by MMS and adherence to FAA recommended minimum ceilings. It is expected that vessel traffic will not disturb endangered and threatened birds because it occurs in/out of existing port areas greater than one-half mile from critical habitats. It is expected that construction of pipeyards and terminals will not disturb or displace endangered and threatened birds because they will not be constructed in critical habitat within upland or wetland areas.

Accidental events such as oil spills and loss of trash and debris may adversely affect endangered and threatened birds. It is assumed that the combination of lessees obeying special MMS notices and enactment of MARPOL, Annex 5, greatly reduces if not eliminates future OCS-related loss of trash and debris. The effect on endangered and threatened birds from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 birds. The effect on endangered and threatened birds from oil spills is expected to be primarily sublethal and less than one generation in duration with fewer than five deaths of the brown pelican and piping plover. All deaths of endangered and threatened birds affected by spilled oil will be replaced through natural recruitment from the next generation.

CONCLUSION: As a result of the proposed action, there will be no discernible decline in an endangered or threatened bird population or species, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Nonendangered Species

A number of routine activities such as OCS helicopter and vessel traffic, pipeline landfalls and construction of coastal facilities may adversely affect marine and coastal birds. OCS offshore helicopter flights will not disturb marine and coastal birds because of notices by MMS and adherence to FAA recommended minimum ceilings. Vessel traffic will not disturb marine and coastal birds because it occurs in/out of existing port areas. The new pipeline landfalls and piping through coastal areas are estimated to affect 27 ha of marine and coastal bird habitat. It is expected that construction of pipeyards and terminals will not disturb or displace marine and coastal birds because they will be constructed in upland areas and not in wetlands. It is expected that pipeline landfalls will disturb and/or displace marine and coastal birds within and from, respectively, 27 ha of coastal area.

Accidental events such as oil spills and loss of trash and debris may adversely affect marine and coastal birds. It is assumed that one spill of 1,000 bbl or more will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is estimated that the oil spill will contact and affect 50 km of beach, 25 km of inshore shoreline, and 16 ha of wetlands. It is estimated that small oil spills will contact and affect 100 ha of estuaries. Lethal effects are expected for no more than 100 birds from direct oiling. Sublethal effects are expected for no more than 1,000 birds from contact with oil and contamination of food sources.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a marine or coastal bird population or species, and no change in distribution or abundance. Any affected individuals, by death or sublethal effects, will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Atlantic Region

(a) Threatened or Endangered Species

Potential impact-producing factors which have been discussed previously. These factors include noise, the presence of platforms, artificial lights, muds and cuttings discharges, geophysical surveys, vessels and helicopter traffic.

Special protections will insure the safeguarding of endangered and threatened birds. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriate actions to determine the extent and the degree to which potential impact-producing factors may affect the resource. These actions may result in modification of activities proposed for exploration and development plans.

Alternative VI is equivalent in terms of infrastructure, activity levels, and duration to the proposal (Section IV.D.1.a). There are 35 exploration/delineation wells and 108 development/production wells assumed under Alternative VI. Six platforms will be placed offshore and these will be serviced by vessels and aircraft from 2 supply bases and 2 heliports. Recovered natural gas will be transported by 3 pipelines with 3 separate landfalls and any recovered oil will be brought to shore by tanker.

The deferral of canyon head areas would involve a total of 44 blocks distributed over Block, Hudson, Toms, Carteret, Lindenkohl, Spenser, Baltimore, Accomac, and Washington canyons. Deferral of these blocks would have the potential to affect only those species which occur over offshore waters. As a result, the bald eagle and piping plover would not be affected the activities assumed for by Alternative VI. The species which may occur within the canyon deferral areas are the roseate tern, and peregrine falcon. There is no record of the Bermuda petrel occurring north of Cape Hatteras. Therefore, this species is not expected to be affected by adoption of Alternative VI.

The roseate tern, and peregrine falcon occur offshore as migrants and could be exposed to OCS activities in pelagic waters. The roseate tern may occasionally forage at or near drilling sites. However, the peregrine falcon is a terrestrial species and is not likely to come in contact with the water. This reduced the potential for impacts on the species substantially.

There is little reason to expect that any measurable impacts would accrue to the endangered and threatened birds due to routine gas and oil operations on the mid- and south Atlantic OCS. Noise due to offshore operations is not expected to measurably affect those species that may occasionally occur over pelagic waters in the vicinity of drilling activities. Likewise, the discussion in Section IV.D.1.a(5) indicates that structures or artificial lighting are not expected to result in measurable impacts on seabirds or migratory terrestrial bird species. Although individual birds may on occasion be startled or displaced by helicopter or vessel traffic, these impacts are short-term and not expected to affect whole bird populations. Muds and cuttings are non-toxic and rapidly diluted in the marine environment. Therefore, this material is not expected to measurably affect endangered or threatened birds occurring in offshore areas. Pipeline construction, either offshore or in coastal waters, is not expected to measurably affect endangered or threatened birds.

The small spill and the majority of the operational discharges are assumed to occur offshore. These spills, because of the relatively small quantities of hydrocarbons involved, are expected to disperse rapidly due to evaporation, wind, and wave action. Those few operational discharges which are assumed to occur at support facilities or between supply bases and offshore platforms would undergo a similar fate. No coastal endangered or threatened species are expected to be affected by spills at or near supply bases. Existing facilities are assumed, these facilities are in developed areas are not known to support endangered or threatened birds. Offshore discharges and spills are also not expected to measurably impact endangered or threatened birds. As migrants and terrestrial species, neither the peregrine falcon are likely to come in contact with water. Therefore, the risk of contact with oil is minimal for these species. Although both the roseate tern and Bermuda petrel are seabirds, neither terns nor petrels in general are considered particularly vulnerable to oiling. It is therefore, not expected that either of these species would experience measurable impacts due to chronic discharges or the assumed single small spill.

Even in the absence of special protections, it is not expected that any measurable impacts on endangered or threatened birds would occur.

Alternative VI is not expected to result in more than a negligible benefit to endangered or threatened bird populations. Therefore, due to the similar levels of activity between this alternative and Alternative I, no change in impact conclusion is expected for endangered and threatened marine and coastal bird populations.

CONCLUSION: No measurable impacts on endangered or threatened birds will be expected under Alternative VI.

(b) Nonendangered Species

Potential impact-producing factors which would be associated with this alternative have been previously described. Special protections will insure the safeguarding of nonendangered and nonthreatened birds similar to threatened or endangered species.

Alternative VI has an assumed level of offshore activity as Alternative I. An analysis of impacts for this level of offshore activity can be found in Section IV.D.1.a(5). It is not expected that routine operations associated with OCS gas and oil activities will measurably affect nonendangered and nonthreatened bird populations on the Atlantic OCS. Noise is not a potential impact-producing factor likely to result in more than negligible impacts. Likewise, geophysical surveys, and vessel and aircraft traffic are not expected to measurably affect these species due to the short-term and sublethal nature of their impacts on individual birds. As discussed in the proposal, offshore structures and artificial lighting are not expected to cause collisions between birds and platforms or other adverse impacts on these species. Muds and cuttings discharges are non-toxic and rapidly diluted in the offshore environment. No measurable impacts from this activity are likely. Likewise, pipeline construction is not expected to affect nonendangered and nonthreatened bird populations.

It is likely that some birds will be affected by the assumed 20 chronic operational discharges and the single small oil spill. However, as present in the analysis for Alternative I, it is not possible to predict how many birds are likely to be impacted by such accidents. However, given the number of accidental discharges assumed, it is not expected that any nonendangered and nonthreatened bird population would suffer a measurable impact as a consequence of accidental oiling. It is expected that the impacts associated with these accidents would not exceed natural fluctuations in mortality among the majority of species which could be affected. Those species of petrel and other seabirds with limited population size and low reproductive capacities are also not expected to be measurably impacted.

Impacts are expected to be slightly reduced only for those species which occur offshore and utilize the waters near the canyons. As a result, coastal seabirds, shorebirds, wading birds, and most waterfowl would be unaffected by adoption of this alternative. Those pelagic species which do utilize the waters around the canyons may receive some slight benefit as a result of the adoption of this alternative. However, because of the similar level of activity with that of Alternative I (see Section IV.D.1.a(5)), it is not expected that the impacts for Alternative VI would differ from that of Alternative I.

Even in the absence of special protections, no measurable impacts on nonendangered and nonthreatened marine and coastal birds are expected.

CONCLUSION: No measurable impact on the population size, distribution, or behavior among nonendangered and nonthreatened marine and coastal birds is expected under Alternative VI.

f. Impacts on Fish Resources

(1) Gulf of Mexico Region

(a) Gulf Sturgeon

Accidental events such as oil spills may adversely affect Gulf sturgeon. It is assumed that one of the larger size class spill will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas. Numerous small spills are assumed to occur and disperse rapidly along a stretch of coast extending from western Mississippi to eastern Texas. Less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. It is also assumed that the oil spill will contact and affect 16 ha of estuaries. The small oil spills are assumed to contact and affect 100 ha of estuaries. It is assumed that the oil spills will not contact Gulf sturgeon due to their limited home range. Only sublethal effects on Gulf sturgeon are expected from contact with small oil spills.

CONCLUSION: As a result of this alternative, the effect on Gulf sturgeon is expected to be undetectable and recovery from any sublethal effects will require less than one year.

(b) Other Fish Resources

A number of routine events such as operational discharges, structure removals, and seismic surveys may adversely affect fish resources. It is assumed that offshore discharges of drilling muds and produced waters will rapidly dilute to background levels and not affect fish resources. Lethal effects to demersal species resulting from explosive platform removals would occur up to 50 m from the detonation site and sublethal effects to fish with internal air chambers extend to 150 m. It is assumed that only airguns will be used in seismic surveys as a result of the proposed action and not affect fish resources.

Accidental events such as oil spills and subsurface blowouts may adversely affect fish resources. It is assumed that one spill of 1,000 bbl or more will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. The oil spill is assumed to contact and affect 16 ha of estuaries; whereas, the smaller oil spills are assumed to contact and affect 100 ha of estuaries. Both lethal and sublethal effects on fish resources are expected from oil spills. It is estimated that a total of 21 subsurface blowouts will occur and assumed that blowouts cause lethal effects on fish resources within 50 m and sublethal effects within 150 m of the blowout site.

CONCLUSION: As a result of this alternative, the effect on fish resources is expected to be undetectable to estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters, to pelagic species such mackerels, cobia, bluefish, amberjack, and dolphin fish, and to reef fish species such as grouper, snapper, gag, scamp, and seabass. Any loss of fish resources will be replaced through natural recruitment from the next generation. The principal cause of impacts is spilled oil, and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Atlantic Region

Effects on fish resources can result from the discharge of muds, cuttings, formation or produced waters, and other operational effluents; platform and pipeline emplacement; structure removal; lights and noise on offshore structures; and geophysical surveys.

If the general biological stipulation were in place, the Regional Director would provide any necessary special protection for fish resources. Possible methods for safeguarding fish resources, and species and habitats that may be at risk, are discussed in Section IV.D.1.a(6).

It is assumed that small operational hydrocarbon spills will occur, potentially causing lethal or sublethal effects on fish eggs, larvae, juveniles, and adults.

Under Alternative VI, drill muds and cuttings would be discharged from 143 wells. Potential effects of drill muds on fish resources are discussed in Section IV.D.1.a(6). Most water-based muds (those permitted under NPDES regulations) are relatively nontoxic. Sublethal or lethal impacts on ichthyoplankton may occur on the order of 10's or 100's of meters from the discharge point (NAS, 1983; Neff, 1987). As discussed in Section IV.D.1.a(6), treated domestic and sanitary wastewaters and deck drainage near the point of discharge can be expected to cause sublethal effects on plankton supporting the food web for fish resources. However, effects would be minor and localized, and therefore no effects even on individual fish higher in the food web are expected.

The principal source of mechanical disturbance assumed under Alternative VI is gas pipeline emplacement. Assuming that 182 km (113 mi), or one third of the total trunkline mileage, requires burial because it is inside the 60-m (197-ft) isobath, such pipeline burial would disturb about 3.6 km^2 (1.4 mi^2) of the bottom, as discussed in Section IV.D.1.a(6). In contrast, benthic habitat for organisms such as surf clams is very large (see Section IV.D.1.a(6)). Thus, no impacts on whole populations of shellfish or benthic forage organisms for demersal predatory fish are anticipated.

Six platforms are assumed in the mid-Atlantic and south Atlantic under Alternative VI. These structures could aggregate fish or increase fish production, as discussed in Section IV.D.1.a(6). Only about 0.12 km2 (0.05 mi2) of bottom area would be disturbed by all six platforms combined. Therefore, only impacts on individual shellfish or demersal fish and not on whole populations are expected. A total area of at least 1.8 km2 (0.7 mi2) would be affected by removal of all six platforms using bulk explosives; other methods would disturb less area but could only be used under certain circumstances.

Impacts of airguns used in geophysical surveys are discussed in Section IV.D.1.a(6). Lethal impacts or physiological stress are confined to an area within about 1.5 m (5 ft) of an airgun. Impacts of other man-made noises from such sources as engines and ship propeller cavitation are discussed in Section IV.D.1.a(6). Sounds originating from OCS activities are expected to cause effects on fish behavior only in the immediate vicinity of the source and hence will not depress whole fish stocks. Lights on offshore structures can attract some fish and can disrupt diel vertical migrations by others, as discussed in Section IV.D.1.a(6). However, as with man-made sounds from airguns and other sources, only individuals and not whole stocks are expected to be affected, and only temporarily.

Formation water may be discharged during or after drilling operations, or during gas or oil production. Impacts of discharged formation water are discussed in Section IV.D.1.a(6). If necessary, formation water can be reinjected into deep rock strata. Minor osmotic stress from hypersaline formation water could occur within a few meters of the point of discharge, but no serious effects on ichthyoplankton or adult or juvenile fish are expected.

Impacts of oil spills on fish resources are summarized in Section IV.D.1.a(6). Oil may be taken up and metabolized by fish. Metabolites are usually more easily excreted than parent compounds but some are known carcinogens. Twenty spills of >1 to 50 bbl and one spill of > 50 to < 1,000 bbl are assumed. The most serious impacts are expected to be on shorelines in quiet water, where accumulation and persistence of the oil in the sediments may cause recovery to take anywhere from 2 to about 12 years (Teal and Howarth, 1984). However, the length of shoreline contacted would be minute relative to the total length of shoreline in the Mid- and South Atlantic Bights. A small oil spill may contact individuals in the ichthyoplankton, including open-ocean pelagic species, shelf species, and shelf-spawning estuarine-dependent species. The location and time of year of the spill would determine the species affected. In summary, sublethal or lethal effects on individual eggs, larvae, juveniles, or adults can occur. However, whole stocks are not expected to be measurably affected.

Emplacement of drillship anchors and platforms, platform removal, pipelaying, and discharge of cuttings can disrupt Atlantic calico scallop beds, as well as the attached epiflora and epifauna of live-bottom areas, if protection by stipulation is not in place. For example, pipelaying, the major source of mechanical disturbance from OCS gas and oil activities, could bury 0.1 to > 4 percent of an Atlantic calico scallop bed (as shown in Section IV.D.1.a(6)).

In summary, routine operational discharges could have sublethal effects on fish food organisms near the point of discharge, especially within a distance of a few meters. In the first phase of drilling of a well, cuttings would bury benthic food organisms and shellfish within 10's of meters of the wellhead. Trenching and jetting for pipeline emplacement, as required in water less than 60 m (197 ft) deep, will bury benthic organisms within about 10 m (33 ft) on each side of the pipeline. Emplacement of all six platforms assumed under Alternative VI can damage a total area of about 0.12 km2 (0.05 mi^2). Drilling rigs will be required for each of the 35 exploration and delineation wells assumed under Alternative VI; light and man-made sounds from such rigs and from platforms will have no impact on behavior or physiology beyond the immediate vicinity of the source. Produced waters may osmotically stress fish within a few meters of the points of discharge.

Lethal or sublethal impacts on individual eggs, larvae, juveniles, or adults can result from a small oil spill. The most damaging effects are expected to result from inshore contamination of sediment or aquatic vegetation along an affected shoreline in quiet waters.

CONCLUSION: Individual finfish or shellfish may experience sublethal impacts or mortality, but no measurable declines in whole stocks are expected. The anticipated duration of impacts on fish resources under Alternative VI is less than one generation or 1 to 3 years, except that shoreline habitat may require anywhere from 2 to about 12 years to recover.

g. Impacts on Reptiles

(1) Gulf of Mexico Region

A number of routine events such as anchoring, structure installation, pipeline placement, dredging, operational discharges, vessel traffic, and explosive platform removals may adversely affect threatened endangered marine turtles. It is expected that effects on marine turtles from anchoring, structure installation, pipeline emplacement, dredging, and operational discharges will be indistinguishable from the long-term (25-50 years) natural variability within populations of marine turtles. It is expected that marine turtles will avoid 5-10 m^2 of live bottom areas for up to a month and that this avoidance of impoverished foraging areas will have no effect on marine turtles. The suspended particulate matter in operational discharges offshore are expected to cause sublethal effects by inhibition of the ability of marine turtles to visually locate its prey within one kilometer of the discharge point for the short time period (less than one hour) spent traversing the plume. The effects on marine turtles from service-vessel traffic is expected to be limited to within 15 m of the vessel, to be sublethal, and of a temporary nature lasting less than an hour. It is expected that structure removals will cause sublethal effects on marine turtles beyond 50 m of the detonation of a short-term nature lasting less than one week. No deaths are expected due to the MMS guidelines for explosive removals.

Accidental events such as OCS-related trash and debris, oil spills, and oil spill response activities may adversely affect marine turtles. The effect on marine turtles from OCS oil/gas-related trash and debris is expected to be undetectable, solely sublethal, of less than one generation in duration, and affect fewer than 10 turtles. The effect on marine turtles from oil spills is expected to be primarily sublethal and last less than one generation with fewer than five deaths. All individual deaths affected by spilled oil will be replaced through natural recruitment from the next generation. It is expected that the effects from oil spill response activities would be sublethal to marine turtles causing avoidance of 116 ha of oiled coastal areas for one month.

CONCLUSION: As a result of this alternative, there will be no discernible decline in a marine turtle population or species, and no change in distribution or abundance. Any deaths will be replaced through natural recruitment from the next generation. Any sublethal effects will last less than one generation. The principal cause of impacts is spilled oil and the probability ranges up to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(2) Atlantic Region

Marine turtles are subject to a variety of lethal and sublethal impacts. The most significant impact source is entanglement or capture in fishing gear. Collisions with vessels also result in lethal or severely debilitating injuries. Nesting habitat has been degraded by coastal development in many locations as have local developmental and foraging waters. Nests are destroyed by recreational activities and in beach areas with artificial lighting newly emerged turtles are often disoriented and may not be successful in their attempts to reach the sea. Chronic chemical pollution is another source of impacts that has been well documented for marine turtles species on the Atlantic OCS.

Potential impact-producing factors associated with routine OCS gas and oil activities include noise, vessel and aircraft traffic, geophysical surveys, muds and cuttings discharges, and pipeline construction. Additional potential impact-producing factors which remain uncertain in their possible effects on turtles include the presence of offshore structures and artificial lights at sea.

Accidental impacts which are assumed for Alternative VI center on the accidental discharge of oil or refined hydrocarbons. Over the estimated 30 year duration of this alternative 20 chronic operational discharges of up to 50 bbl are assumed. In addition, 1 small spill (50 bbl to ,000 bbl) is assumed. The majority of these spills will occur in offshore waters. No oil spills of 1,000 bbl or more are assumed under the Alternative VI.

Special protections will insure the safeguarding of endangered and threatened marine turtle species. Should specific concerns be identified, the Regional Director may require the lessee to undertake appropriate actions to determine the extent of the affected resource and the degree to which potential impact-producing factors may affect the resource. These actions may result in modification of proposed operations.

Alternative VI is equivalent in terms of infrastructure, activity levels, and duration to that described for the base case (Section IV.D.1.a(7)).

The deferral of canyon head areas would involve a total of 34 blocks distributed over Block, Hudson, Toms, Carteret, Lindenkohl, Spenser, Baltimore, and Accomac canyons. The deferral of these blocks could result in a slight reduction of the potential impact-producing factors for species of endangered or threatened marine turtles which are occur in pelagic waters such as the leatherback turtle. Whether juvenile loggerhead and green turtles occur in those areas considered for deferral under Alternative VI is uncertain. Although some juvenile turtles of could be transported to mid-Atlantic canyon waters by warm core rings or eddies originating with the Gulf Stream, the fate of these individuals is unknown. Whether a canyon head alternative involving deferral of these blocks would be of any benefit to these individuals is not known.

The leatherback turtle is the only species which can be considered to have a regular pelagic occurrence in habitat which could be affected by this alternative. However on the basis of the very limited number of blocks which would be affected (34) benefits due to adoption of Alternative VI would likely be negligible.

As discussed in Section IV.D.1.a(7) the potential impact-producing factors associated with routine offshore gas and oil activities at the level of activity proposed for Alternative VI are not expected to measurably affect marine turtles. In part this is due to the inshore distribution of most individuals and species which removes the majority of these populations from most sources of potential impacts. For those individuals which might encounter offshore gas and oil activities the most prevalent potential impact-producing factors appear to be noise, vessel and aircraft traffic, muds and cuttings discharges, and pipeline construction.

Noise from platforms appear appears to have little affect on marine turtles in general as these animals are frequently associated with gas and oil platforms in other OCS areas. Due to the requirement for tension leg platforms and the current regimes expected offshore in non-deferred areas it is not likely that 6 platforms would produce measurable noise impacts on marine turtles, or that turtles would be particularly attracted to these structures for food or shelter. Geophysical survey activities would likely produce short-term startle reactions and subsequent avoidance responses among affected turtles. Vessel traffic and aircraft are known to cause occasional startle reactions in other OCS areas and similar impacts could be expected for marine turtles on the mid- and south Atlantic OCS. Muds and cuttings discharges are non-toxic and rapidly diffuse in the current regimes expected offshore. No measurable impacts due to the discharge of this material are expected for marine turtles. Offshore, pipeline construction would likely result in no measurable impacts on marine turtles. Within inshore areas, a few marine turtles could be injured or killed due to dredging activities were these to be undertaken during the winter months. However, the number of turtles which might be killed would be unlikely to result in measurable impacts at the species level.

Accidental discharges considered under Alternative VI include 20 assumed chronic operational discharges and 1 small oil spill. Chronic operational discharges are not expected to measurably affect marine turtle populations due to the rapid evaporation of volatile materials and relatively quick dispersal of remaining materials by wind and wave action. A small oil spill would be expected to retain the potential for producing impacts on individual turtles for a somewhat longer period. Were at turtle to contact freshly spilled oil, and, depending on the length of contact, fairly severe physiological but reversible impacts may occur (see Section IV.D.1.a(7)). Soft tissues may become inflamed and ingestion may result in changes to various physiological functions. Ingestion of weathered oil in the form of tarballs may be fatal due to obstruction of the windpipe or blockage of the digestive tract. However, in light of the assumed single small oil spill, no measurable impacts on marine turtle populations are expected.

It is not considered likely that the deferral of 34 blocks which represents the total block deferral for Alternative VI would result in more than a negligible benefit to marine turtle populations which could occur within canyon habitats. Likewise, the inshore distribution of other marine turtle species would be likely limit any benefits which would occur due to a canyon head lease block deferral. Due to the similarities between this alternative and the base case scenario activities, no change in impact conclusion from that of the base case scenario is expected for endangered and threatened Atlantic OCS marine turtle populations.

In the absence of special protections, no measurable impacts on marine turtle populations.

CONCLUSION: Under Alternative VI, no measurable impacts affecting population size, distribution, or behavior of endangered and threatened marine turtles due to routine OCS gas and oil activities or oil spills are expected to occur.

h. Impacts on Coastal Habitats

(1) Gulf of Mexico Region

(a) Wetlands and Estuaries

Impacts from accidental discharges of oil could affect approximately 100 ha of wetlands, mainly along the western Louisiana to eastern Texas coasts. In the areas affected, damage to wetlands will include temporary die back of the above ground vegetation, some complete plant mortality, and accelerated rates of land loss (the conversion of wetlands to open water). The disposal of OCS-derived produced waters in coastal Louisiana is not expected to affect adjacent wetland areas based on the results of field studies. New dredging and construction projects in wetland areas include pipeline landfalls, navigation channel maintenance dredging and deepening, and new infrastructure construction. The four new pipeline landfalls are expected to affect 27 ha of wetlands. Maintenance dredging and deepening of navigation channels will affect wetlands mainly in coastal Louisiana where wetlands typically fringe navigation routes. In addition, the use of channels by OCS vessels will result in accelerated erosion of as much as 30 ha of wetland fringed channel banks. The construction of one new pipe yard and three new terminals is projected to occur along the south Texas and Alabama coasts where ample amounts of upland occur near the coast. Given the current regulatory environment, it is likely that these facilities will be constructed on coastal uplands rather than wetlands.

CONCLUSION: This alternative is expected to result in temporary (one growing season or approximately 6 months) dieback of up to 100 ha of wetlands that have been contacted by spilled oil. Some of these wetland areas could be converted to open water habitat where higher concentrations of oil accumulated resulting in plant deaths eventual land loss. The probability of one or more spills (greater than or equal to 10,000 bbl) occurring ranges up to 22 percent. Up to 30 ha of wetlands could be eroded along navigation channels as a result of OCS-vessel traffic within the channels. Most wetland impacts will occur in Louisiana and along the north Texas coast.

(b) Barrier Beaches

Although some contact to barrier beaches from accidental spillage of oil will occur along the Louisiana and Texas coasts, the oil will be cleaned from the beach with no permanent affects on the configuration of the barrier feature. Construction activities associated with the proposed action, including pipeline landfalls, infrastructure construction, and maintenance dredging and deepening of navigation channels, are expected to have minimal impacts. Using proper construction techniques, pipeline landfalls can be done with no observable effects on barrier beaches. New construction projects will not likely be located on barrier beaches or islands. Maintenance dredging and channel deepening may have some erosional effects on beaches downdrift from the navigation channel, but these impacts will be localized.

CONCLUSION: This alternative is not expected to result in permanent alterations of barrier beach configurations, except in localized areas near navigation channels that have been dredged and deepened.

(2) Atlantic Region

(a) Wetlands and Estuaries

The existing conditions of the Atlantic estuaries and wetlands are described in Section IV.D.1.a(8). Routine OCS activities that could impact estuaries or wetlands under this alternative stem from supply and tanker vessel traffic to and from drilling rigs and platforms, and from the emplacement of gas pipelines in the coastal area.

Accidents that could impact estuaries and wetlands arise from small spills of diesel fuel from supply vessels and small to large spills from tankers transporting crude oil to refineries. Supply vessel spills that could impact estuaries and wetlands would most likely occur only in the immediate vicinity of the areas used as support bases. The greatest chance of a spill of 1,000 bbl or more affecting estuaries and wetlands would be in the vicinity of refineries. Oil produced from the Atlantic OCS would most likely be transported by tankers to refineries in Delaware Bay or possibly Raritan Bay.

Impacts on estuaries and wetlands from vessel traffic related to OCS activities stem from ship wakes eroding the shoreline. Since all vessel traffic is assumed to use established port facilities, impacts are expected to be imperceptible.

Construction of pipelines in the coastal area can affect estuarine and wetland areas. Pipelines coming ashore in the Mid-Atlantic Bight are not likely to encounter estuaries and wetlands but will come ashore in areas where the beach is part of the mainland. This is the case at Seagirt, NJ and Cape Henry, VA. In the South Atlantic Bight, a pipeline would most likely need to pass through some estuarine or wetland environments. Most of the effects from a pipeline are expected to occur during construction. The effects of the construction methods are explained in Section IV.D.1.a(8). While complete recovery of the area disturbed during pipeline construction can take several years, the direct impacts affect only a limited area and are temporary. Pipeline corridors are expected to revegetate in 2 years. Proper construction and restoration methods will allow the area to return to preconstruction conditions and are not expected to result in modification of water flow, loss of wetlands, or altered salinity regimes.

Small spills from supply vessels are not expected to affect estuaries and wetlands in the vicinity of the support bases for any more than one growing season. These small spills would be diesel fuel which would evaporate or be cleaned up with sorbents before they could penetrate into the sediment and endanger the root systems of the marsh and sea grasses.

Impacts from OCS vessel traffic are expected to be imperceptible. Pipeline construction will temporarily destroy vegetation and habitat along the pipeline corridor. With proper reconstruction, revegetation can occur in 2 years. These impacts are expected only if pipelines come ashore near Wilmington, North Carolina or Charleston, South Carolina. Impacts from accidents are expected to be limited to temporary shifts in flora and fauna ratios caused by small spills in the vicinity of support bases. These will most likely be imperceptible in areas with existing daily ship traffic, such as Atlantic City, New Jersey and Morehead City, North Carolina.

CONCLUSION: Under Alternative VI, impacts on estuaries and wetlands are expected to be imperceptible except in areas disturbed for pipeline construction. Pipeline corridor impacts will be of limited extent (less than 0.5% of Atlantic estuarine environment) with pre-impact conditions returning in approximately 2 years.

(b) Shorelines

The existing conditions of the Atlantic estuaries and wetlands are described in Section IV.D.1.a(8). Routine OCS activities that could impact shorelines stem from supply and tanker vessel traffic to and from drilling rigs and platforms, and from the emplacement of gas pipelines in coastal areas.

Accidents that can impact shorelines stem from small spills of diesel fuel from supply vessels and small to large spills from tankers transporting crude oil to refineries. Supply vessel spills that can impact shorelines are assumed to occur in the immediate vicinity of the areas used as support bases. The greatest chance of a spill of 1,000 bbl or more affecting shorelines will be in the vicinity of refineries. Oil produced from the Atlantic OCS will most likely be transported by tankers to refineries in Delaware Bay or possibly Raritan Bay.

The wakes from vessels related to OCS activities can cause erosion of the shoreline. Since all vessel traffic is assumed to use established port facilities, these impacts are expected to be imperceptible. The only measurable impact on shorelines expected from the assumed routine activities is the dredging of a channel through one beach area and through two barrier islands to allow for pipeline emplacement. While this would weaken the barrier islands until vegetation is reestablished (approximately 2 to 3 years.), it will most likely not cause the barrier island to be breached by subsequent storms. Proper construction methods will almost certainly prevent this from happening.

It is assumed that a small diesel fuel spill between 1 and 50 bbl will occur in the vicinity of each of the support bases and at the mouth of Delaware Bay. Impacts that could be expected to shorelines, if these spills occur, will be mostly visual and last only for a few days. Most of the diesel fuel is expected to evaporate within one day, with any remaining fuel dissipating from the rapid sand movement that occurs along the Atlantic shorelines. No measurable impact to shorelines is expected from small spills.

CONCLUSION: Under Alternative VI, impacts to shorelines will occur only at pipeline landfall locations. The maximum area affected will be a 15 m (50 ft) swath across the beach. Recovery is expected to be complete in 2 to 3 years.

i. Impacts on Seafloor Habitats

(1) Gulf of Mexico Region

(a) Chemosynthetic Communities

The only impact-producing factor threatening the chemosynthetic communities is physical disturbance of the bottom, which would destroy the organisms comprising these communities. Such disturbance would come from those OCS-related activities associated with pipelaying, anchoring, structure emplacement, and seafloor blowouts. Only structure emplacement is considered to be a threat, and then only to the high-density (Bush Hill-type) communities. The widely distributed low-density communities would not be at risk. The provisions of NTL 88-11 (currently in effect), requires surveys prior to drilling and avoidance. This will greatly reduce, but not completely eliminate, the risk.

CONCLUSION: The activities associated with this alternative are expected to cause little damage to the physical integrity, species diversity, or biological productivity of either the wide-spread low-density chemosynthetic communities or the rarer, widely scattered high-density Bush Hill-type chemosynthetic communities. Recovery from any damage is expected to take less than two years.

(b) Topographic Features

This alternative differs from the proposed action only by not offering the unleased blocks that would be affected by the mitigation measures similar to the topographic features stipulation of previous sales in this area. These are the blocks in which routine oil and gas activities may potentially have adverse impacts on the sensitive biota of the nearby topographic feature. By not offering these blocks, potential impacts to the banks from routine oil and gas operations would be eliminated. Furthermore, adopting this alternative would eliminate the need for mitigating measures similar to those provided by a topographic features stipulation.

The sources and severity of impacts associated with this alternative are the same those sale-related activities discussed for Alternative I. As noted in Section IV.D.1.a, the potential impact-producing factors from routine activities to the topographic features of the Gulf of Mexico are anchoring and structure emplacement and removal, and operational discharges (muds and cuttings, produced water). Impact-producing factors from accidents include blowouts and oil spills.

Of the potential impact-producing factors to the topographic features, anchoring, structure emplacement, and structure removal will be eliminated by the adoption of this alternative. Effluent discharge and blowouts will not be a threat because blocks near enough to the banks for these events to have an impact on the biota of the banks will have been excluded from leasing. Thus, the only impact-producing factor remaining, from operations in blocks included in this alternative (i.e., those blocks not excluded by this alternative), is an oil spill.

As noted above, it is estimated that three oil spills (greater than or equal to 1,000 bbl) would occur from program-related activities. One 25,000 bbl pipeline spill would occur offshore Texas and two spills (one 20,000 bbl platform spill and one 25,000 bbl pipeline spill) would occur in the northcentral Gulf offshore Louisiana/Mississippi/Alabama. In addition, one 30,000 bbl tanker spill would occur offshore Texas from oil imports. Of the topographic features in the Gulf, the East Flower Garden Bank crests the shallowest at 15 m. Therefore, a surface oil spill would likely have no impact on the biota of the East Flower Garden Bank or the other topographic features because any oil that might be driven to 15 m or deeper would be well below the concentrations needed to cause an impact. A seafloor oil spill would have to come into contact with a biologically sensitive feature in order to have an impact. The fact that the topographic features are widely dispersed in the Gulf, combined with the probable random nature of spill locations, would serve to limit the extent of damage from any given spill to only one of the sensitive areas. The currents that move around the banks will steer any spilled oil around the banks rather than directly upon the banks, lessening the severity of impacts.

CONCLUSION: The impact of the selection of this alternative is expected to result in essentially no impact to the sensitive offshore habitats of the topographic features.

(c) Live Bottoms

The impact-producing factors resulting from routine activities of oil and gas operations include mechanical damage caused by underwater oil spills, blowouts, anchoring, structure emplacement and removal, drilling discharges, and pipeline emplacement. These activities may threaten the sessile and pelagic communities associated with the crest and flanks of the hard bottom and low-relief hard-bottom features of the region. Because protection similar to that of the biological stipulations are assumed to be attached to leases issued as a result of this proposal, the effects from these factors will have been mitigated on the biota of the hard bottoms. The potential impacts from spilled oil include uptake of hydrocarbons and reduced visibility; these impacts may be serious or fatal to the local biota.

A blowout within a 100 m of a hard bottom community could result in the smothering of the biota within a very limited area of a hard bottom due to sedimentation. The placement of drilling rigs, platforms, and anchors on the seafloor will crush the organisms directly beneath the legs or mat used to support the structure. Structure placement and anchor damage from support boats and ships, floating drilling units, and pipeline-laying vessels disturbs areas of the seafloor and is the most serious threat to live-bottom areas at these depths. Structure removal using explosives (the most common removal method) could suspend sediments throughout the water column to the surface and may cause substantial impacts to nearby habitats. Deposition of these sediments would occur largely within the first 100 m of the site. Explosive structure removals create shock waves, which could also harm resident biota in the immediate vicinity. Smothering of organisms through deposition of drilling discharges (drill muds and cuttings) may occur; less obvious sublethal effects may also take place. Pipeline emplacement directly affects the benthic communities through burial and disruption of the benthos, and through resuspension of sediments. These resuspended sediments may clog filter-feeding mechanisms and gills of fishes and sedentary invertebrates. The majority of these impacts are mitigated through implementation of the biological stipulations or comparable measures. Because protection similar to that of the biological stipulations will be attached to leases issued as a result of this alternative, the effects from these factors will have been mitigated on the biota of the region. This proposed alternative would not change the OCS-related activities which were detailed for Alternative I. No reduction in the number of exploration and delineation wells would be evident due to the exclusion of the sensitive bathymetric features. Likewise, no reduction in the number of development and production wells, number of platform installations and removals, miles of pipelines installed, or potential oil spills would be seen.

CONCLUSION: The impact of this alternative on the hard bottom trend region is expected to be such that any changes in the regional physical integrity, species diversity, or biological productivity of the hard bottom region would recover to pre-impact conditions in less than two years, more probably on the order of 2-4 months.

(2) Atlantic Region

(a) Benthic Communities

Impacts on benthic communities from routine activities will result primarily from the discharge of muds and cuttings to the seafloor (Section IV.D.1.a). These discharges will bury infauna and epifauna within several hundred meters of the wellhead, causing the direct mortality of many of these organisms. At the water depths of the proposed lease blocks, wastewater discharges are not expected to impact benthic communities. Trunklines and gathering lines will disturb sediments in shallow water areas (60 m [200 ft]) where federal regulations require that pipelines be buried (Section IV.D.1.a). However, the deferral of 34 blocks, which would eliminate OCS activities and the resulting impacts from all submarine canyons, is not expected to change the impacts on benthic communities within the remaining potential lease blocks.

Although no oil spill of 1,000 bbl or more is assumed under this scenario, small operational spills and 1 larger oil spill are assumed to release hydrocarbons into the area. However, considering the depths at which these benthic communities occur, no impacts which could be distinguished from natural variation are expected to occur from these oil spills (Section IV.D.1.a).

In the absence of special protections, impacts on areas with unique communities or biological resources could occur under Alternative VI. Especially vulnerable to OCS activities are the live bottom habitats of the South Atlantic (Sections III.D.2.f and IV.D.1.a).

If Alternative VI is adopted, impacts on benthic communities are not expected to be different from those outlined in the proposal. The major effect from routine OCS activities will be the death by burial of individuals within several hundred meters of the wellhead. At the depths of the proposed activities, recovery of locally impacted communities is expected to proceed slowly (3 to 5 years) and possibly result in recolonization by a different community. Recovery of nearshore communities is expected to occur within 1 to 3 years. No impacts on benthic communities associated with the release of hydrocarbons are expected.

CONCLUSION: Under Alternative VI changes in benthic communities are expected to result only from routine activities and last no longer than 1 to 3 years. No measurable regional impact is expected.

(b) Submarine Canyons

Routine OCS activities assumed under this scenario are similar to those described previously in Section IV.D.1.a. However, if Alternative VI is adopted, 34 potential lease blocks in or adjacent to submarine canyons would be deferred. Most of these blocks lie within four canyons: Toms, Carteret, Lindenkohl, and Accomac Canyons. Although submarine canyons could be identified by the Regional Director as areas requiring special protection, adoption of this alternative would eliminate direct impacts on these areas from OCS activities.

Impacts on submarine canyons from routine activities are primarily associated with the discharge of drilling muds and cuttings to the seafloor (Section IV.D.1.a). Under Alternative VI, drilling and, therefore, discharge of muds and cuttings, in submarine canyons would not occur. Submarine canyon heads may act as sinks for many contaminants (Boehm, 1989; Bothner, 1989), making them vulnerable to indirect effects associated with the release of drilling discharges from sites outside the canyons. Although transport of drilling discharges into canyons from distant sites could occur, adoption of this alternative would reduce this possibility.

Hydrocarbons from oil spills eventually could become incorporated into canyon sediments through transport and resuspension of sediments containing oil. However, because canyons are located in the open ocean where an oil spill would be widely dispersed, and because even the shallowest portions of canyons are in deep water, impacts on canyon communities from an oil spill of >50 to <1,000 bbl are not expected.

Under this alternative, impacts from routine activities on submarine canyons are expected to be reduced or eliminated. No impacts from small operational spills or even a larger oil spill are expected.

CONCLUSION: Impacts on submarine canyons under Alternative VI are not expected to produce any discernible declines in canyon biota. Little or no indirect effects (e.g., physiological or behavioral effects) on these organisms are expected to occur.

j. Impacts on Coastal Communities

(1) Gulf of Mexico Region

(a) Demography and Employment

Selection of the proposed alternative would not reduce the level of exploration, development, and production activity, nor the associated employment, expected to result from Alternative I, Gulfwide. A total of approximately 355,400 person-years of employment (direct, indirect, and induced) are required during the 45-year life of the proposed program. The States of Louisiana, Mississippi, and Alabama are expected to collectively provide almost 78 percent of the total employment required in support of the proposal. Texas contributes over 18 percent of the Gulf Region employment impact. The least impacted state in the Gulf of Mexico Region is Florida, accounting for only four percent of the employment impact projected for the socioeconomic impact area as a result of the proposal. Employment projected to result from oil spill clean-up activities due to the proposed alternative are approximately equivalent to 580 person-years of employment. It is expected that employment demands in support of the proposal will be met with the existing population and available labor force.

CONCLUSION: The proposed alternative is expected to result in a total of 355,400 person-years of employment (direct, indirect, and induced) during its 45-year life. Peak levels of employment are expected to occur in the year 2000, with a total of approximately 16,600 workers involved in primary, secondary, and tertiary industries. Exploratory activities which occur during the first 17 years of the life of the proposed alternative, are the main contributor to peak year employment. The greatest impact is expected in the coastal communities of Louisiana. However, it is expected that employment demands in support of the proposal will be met with the existing population and available labor force.

(b) Public Services and Community Infrastructure

Deletion of designated bathymetric features in the northcentral and northwestern Gulf would only slightly reduce the level of exploration, development, and production activity, and associated employment, relative to the proposed action. Impacts to social patterns would be related to the dramatic changes in population and the disruption of environmental resources, as well as conditions inherent to OCS-related employment (i.e., work scheduling and rate of pay). No positive net migration into northcentral and northwestern Gulf coastal areas is expected to occur from those currently employed in the oil and gas industry, as well as the unemployed and underemployed, and new employees already living in the area. It is expected that jobs created by the alternative would likely reduce the amount of out-migration when compared to scenarios without the proposal and that minor displacement from traditional occupations will occur as a result of the alternative. This displacement will be mitigated, to some extent, by the extended work schedule associated with OCS-related employment. The work schedule is expected to have some deleterious effects on family life in some individual cases. Impacts caused by the displacement of traditional occupations and relative wages are expected to occur to a minimal extent.

CONCLUSION: Under this alternative, minimal stress on public services and community infrastructure would occur.

(c) Social Patterns

Deletion of designated bathymetric features in the northcentral and northwestern Gulf would only slightly reduce the level of exploration, development, and production activity, and associated employment, relative to the proposed action. Impacts to social patterns would be related to the dramatic changes in population and the disruption of environmental resources, as well as conditions inherent to OCS-related employment (i.e., work scheduling and rate of pay). No positive net migration into northcentral and northwestern Gulf coastal areas is expected to occur from those currently employed in the oil and gas industry, as well as the unemployed and underemployed, and new employees already living in the area. It is expected that jobs created by the alternative would likely reduce the amount of out-migration when compared to scenarios without the proposal and that minor displacement from traditional occupations will occur as a result of the alternative. This displacement will be mitigated, to some extent, by the extended work schedule associated with OCS-related employment. The work schedule is expected to have some deleterious effects on family life in some individual cases. Impacts caused by the displacement of traditional occupations and relative wages are expected to occur to a minimal extent.

CONCLUSION: Under this alternative, deleterious impacts to family life are expected to occur in some individual cases, as are minimal impacts to traditional occupations.

(2) Atlantic Region

(a) Demography and Employment

The assumed exploration and development scenario for Alternative VI is the same as that assumed for Alternative I. A description of the potential impacts expected to occur from these infrastructure assumptions is contained in Section IV.D.1.a(10). An oil spill of 1,000 bbl or more is not assumed to occur in the scenario for this alternative.

It is assumed that 35 exploratory and 108 development and production swells will be drilled with resupply services occurring from 2 support bases. Production of the hydrocarbon resources assumed to be discovered will require 6 production platforms, 3 gas pipelines, and 2 gas processing plants. Since these assumptions are the same as those in Alternative I, the impacts on employment and demographics are also expected to be the same. Under Alternative VI, exploration for oil and gas will offer few employment opportunities for coastal residents. Because of their longer period of operation, development and production of discovered resources is expected to increase employment in areas surrounding permanent support bases. However, the increase in the number of jobs are not expected to add measurably to the existing economy. Increases in population as a result of Alternative VI compared to the already high growth rates of coastal counties are expected to be small.

CONCLUSION: Under Alternative VI, the absence of an offshore drilling industry limits employment opportunities for local residents. There is the potential for an increase in the number of jobs available to coastal residents, but this increase is not expected to be substantial compared to the number of jobs already available in coastal economies.

(b) Land Use

Creation of the infrastructure assumed under Alternative VI is expected to require the expansion of existing facilities and the development of undeveloped land. However, existing ports in the region can handle the acreage needs of OCS support bases, thereby avoiding discernible impacts on coastal land use. Additionally, State coastal management programs and other Governmental regulations and permit requirements will direct pipeline landfalls and development of gas processing facilities to appropriate areas.

CONCLUSION: The acreage of the industrial/urban class of land use is expected to increase by 46 to 120 hectares (140 to 300 ac) as a result of Alternative VI. However, this increase is expected to occur in areas within the potentially affected States that are already designated for industrial development and could accommodate the possible siting of facilities related to OCS operations.

(c) Vessel Traffic and Ports

The assumed exploration and development scenario for Alternative VI has been described previously.

Existing traffic routing measures and safety regulations can manage the increases in vessel traffic that will occur from the assumed increases in drilling activity under Alternative VI. Enforcement of marine safety laws and oil spill contingency plans will combine to prevent appreciable impacts from small fuel spills.

CONCLUSION: USCG regulations are adequate for the safe management of all assumed increases in vessel traffic. Existing port facilities can accommodate the assumed increases in vessel traffic under Alternative VI. Therefore, no measurable changes to Atlantic coast vessel traffic is expected.

k. Impacts on Fisheries

(1) Gulf of Mexico Region

(a) Commercial Fishing

A number of routine events such as production platform emplacement may adversely affect commercial fishing. It is estimated that new offshore platforms resulting from the proposal will remove approximately 1,008 ha (2,520 ac) of trawling space from commercial fishing, representing less than 0.01 percent economic loss to the commercial fishing of shrimp and sciaenid groundfish for no more than one fishing season.

Accidental events such as underwater OCS obstructions and oil spills may adversely affect fish resources. It is assumed that 4,360 km (2,705 m) of offshore pipeline will result from Alternative VI. Underwater obstructions will cause a 0.01 percent or less economic loss to the commercial fishing of menhaden, shrimp, and sciaenids for no more than one fishing season. It is assumed that one spill of the larger size class will contact the Gulf coast along a stretch extending from western Louisiana to eastern Texas, and that less than five small spills will contact the Gulf coastline. It is assumed that some spilled oil will penetrate into estuaries. The oil spill is assumed to contact and affect 16 ha of estuaries. The small oil spills will contact and affect no more than 100 ha of estuaries and fish nurseries for less than one fishing season. Both lethal and sublethal effects on commercial fisheries resources and depression of commercial fishing activities will occur.

CONCLUSION: As a result of this alternative, a 0.01-0.1 percent economic loss to commercial fisheries of estuary-dependent species such as menhaden, shrimp, blue crabs, sciaenids, mullet and oysters is expected to occur for one to two fishing seasons (1-2 years). The principal cause of impacts is spilled oil, and the probability ranges to 22 percent that one or more spills of 10,000 bbl or greater will occur.

(b) Recreational Fishing

The proposed program will lead to the installation of new offshore gas and oil production platforms which will function as very large artificial reefs attracting sport fish and fishermen. Large oil spills will temporarily discourage offshore fishing and lead to a loss of fishing activity and a decline in the sale of fishing equipment, supplies and services within the coastal community impacted. The lack of fishing activity and the loss of sales of fishing equipment, supplies and services caused by oil pollution will not extend beyond the community impacted or the days or weeks it takes to clean up the spill.

CONCLUSION: The marine recreational fishing industry is expected to continue its growth and expansion in the Gulf of Mexico in direct association with continued and expanded economic growth in general, and gas and oil leasing in particular. Many of the future offshore fishing trips in the northern Gulf will extend the focus of specific fishing efforts in direct proximity to the new gas and oil platforms expected to result from the proposal. Oil spills (up to a 22% probability of one or more spills greater than or equal to 10,000 bbl) will disrupt fishing activities in the offshore areas directly impacted, and can lead to a decline in the sale of fishing equipment, supplies, and services for up to one fishing season (up to 1 year) when large quantities of oil pollution come ashore in a coastal fishing community.

(2) Atlantic Region

(a) Commercial Fishing

Impacts on commercial fisheries from routine activities result primarily from spatial conflicts between drilling structures and OCS-related vessel traffic and fishing activities and the discharge of drilling muds and cuttings (Section IV.D.1.a). Under Alternative VI, spatial conflicts in submarine canyons would be eliminated. However, this will not measurably change the potential for spatial conflicts as outlined in the proposal (Section IV.D.1.a) because only fixed fishing gear is employed in submarine canyons and few spatial conflicts arise with these fishing techniques. Therefore, the primary effect of adopting Alternative VI is associated with the discharge of drilling fluids.

Discharge of muds and cuttings to the seafloor results in the direct mortality by burial of benthic organisms by burial within several hundred meters of the wellhead (Section IV.D.1.a). Recovery rates at the depths of the proposed activities are expected to be slow (3 to 5 years) and are expected to result in an altered community. Adoption of Alternative VI would eliminate direct impacts to canyon communities which contain commercially important species of fish. Although transport of discharges into canyons from remote drilling sites could still occur, indirect effects (e.g., increased sedimentation rates and elevated barium levels) associated with drilling discharges are not expected to result in measurable changes in canyon communities. Near-surface discharges primarily affect eggs and larvae in the plankton. However, drilling discharges are relatively non-toxic (NAS, 1983) and exposures to discharges in the open ocean are usually brief. Therefore, near-surface discharges are not expected to affect commercial fisheries.

The small operational spills and 1 larger oil spill assumed under this alternative most likely would occur in the open ocean. The release of hydrocarbons into this high energy environment is not expected to result in changes to commercial fisheries which could be detected against natural variation (Section IV.D.1.a). In the absence of special protections, impacts to areas with unique communities or biological resources could be negatively affected under this scenario. Especially vulnerable to OCS activities are the live bottom habitats of the South Atlantic which contain commercial fish resources (Sections III.D.2.f and IV.D.1.a).

If Alternative VI is adopted, impacts to commercial fisheries are not expected to differ from those outlined in Alternative I. Some reduction in spatial conflicts in submarine canyons is expected, but potential spatial conflicts in the remaining potential lease areas are expected to be similar to those outlined in Section IV.D.1.a. The major effect of adopting Alternative VI will be to eliminate the discharge of drilling muds and cuttings into submarine canyons, preventing direct impacts on areas which appear to be refuges for many commercial species (Section III.D.3.b). However, adoption of this alternative is not expected to alter the impacts expected in the remaining potential lease blocks as outlined un the proposal (Section IV.D.1.a).

CONCLUSION: Adoption of Alternative VI is not expected to produce measurable economic losses in commercial fisheries which last longer than one to two seasons. No measurable economic losses in secondary employment is expected.

(b) Recreational Fishing

Under this scenario, the major impact from routine activities will result from discharge of drilling muds and cuttings to the seafloor (see previous discussion and Section IV.D.1.a). Because canyon communities act as refuges for many species of fish, deferring 34 lease blocks would eliminate the direct impacts from these discharges on canyon communities. Under this scenario, the major impact from routine activities will result from discharge of drilling muds and cuttings to the seafloor (see previous discussion and Section IV.D.1.a). Because canyon communities act as refuges and primary habitat for many species of fish, deferring 34 lease blocks would eliminate the direct impact from these discharges on canyon communities. As submarine canyon areas are frequently preferred areas for the pursuit of the larger gamefish species by recreational fishermen Alternative VI which would preclude OCS gas and oil activities within those blocks overlying canyon habitat therefore removing this habitat from potential direct impacts associated with OCS gas and oil activities. As a result, offshore recreational fisheries would be unaffected by any direct impacts associated with routine offshore operations and the presents status of future growth of this recreational industry would not be expected to be directly or measurably affected. Therefore, adoption of this alternative will not change the impacts from OCS activities, as outlined in Alternative I (Section IV.D.1.a), on recreational fisheries.

Under this scenario, the release of hydrocarbons most likely would occur offshore where it is not expected to cause measurable changes in the recreational fishery. In the absence of special protections, areas with unique communities or biological resources could be negatively affected under this scenario. Especially vulnerable to OCS activities are the live bottom habitats of the South Atlantic which contain important recreational fish resources (Sections III.D.2.f and IV.D.1.a).

Under this alternative, impacts from routine activities on submarine canyons are expected to be reduced or eliminated. However, this is not expected to alter the expected impacts from OCS activities on recreational fisheries, as outlined in the proposal (Section IV.D.1.a), in the remaining areas considered for lease. Small operational spills or even a larger oil spill (>50 to >1,000 bbl) are not expected to result in measurable changes in the recreational fishery.

CONCLUSION: Impacts on recreational fisheries under this alternative are not expected to produce measurable economic losses lasting more than one to two seasons. No measurable economic losses in secondary employment are expected.

l. Impacts on Archaeological Resources

(1) Gulf of Mexico Region

HISTORIC: The greatest potential impact to an historic archaeological resource as a result of this alternative would result from a contact between an OCS offshore activity (platform installation, drilling rig emplacement, dredging, and pipeline projects) and an historic shipwreck.

Most other activities associated with this alternative are expected to have little to no impacts on historic archaeological resources. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. Historic cultural resources, therefore, will not be affected by these activities. The chance of contact from an oil spill associated with this alternative and a historic site is very small. Furthermore, the impact from an oil-spill contact on an historic coastal site, such as a fort or lighthouse, would be visual due to oil contamination. These impacts would be temporary (lasting up to weeks) and reversible.

An OCS activity could contact a shipwreck because of incomplete knowledge on the location of shipwrecks in the Gulf. Such an event could result in the disturbance or destruction of unique or significant historic archaeological information. However, it is estimated that magnetometer surveys at 50 m linespacing will be 90 percent effective at locating historic shipwrecks within high probability areas. Other factors associated with this alternative are not expected to affect historic archaeological resources.

PREHISTORIC: Several impact-producing factors may threaten the prehistoric archaeological resources of the Gulf. An impact could result from a contact between an OCS activity (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) and a prehistoric site located on the continental shelf. The archaeological surveys and archaeological clearance of sites that are required prior to an operator beginning oil and gas activities in a lease block are estimated to be 90 percent effective at identifying possible prehistoric sites. Since the survey and clearance provide a significant reduction in the potential for a damaging interaction between an impact-producing factor and a prehistoric site, there is little chance for damaging interaction between an impact producing factor and an archaeological site or resource.

Onshore development as a result of this alternative could result in the direct physical contact between new facility construction, and pipeline trenching. Potential impacts caused by new onshore infrastructure construction or pipeline landfalls are expected to be mitigated as a result of Federal and State laws protecting archaeological resources. There is little to no expected impact from these factors.

Should an oil spill contact a coastal prehistoric site, the potential for dating the site using radiocarbon methods could be destroyed. Oil spill cleanup operations could physically impact coastal prehistoric sites. Previously unrecorded sites could also experience an impact from oil-spill cleanup operations on beaches. Should a spill contact occur unique or significant archaeological information could be lost.

CONCLUSION: As a result of this alternative, it is expected that a historic or prehistoric archaeological site containing significant but not unique information would be disturbed to an extent that the site loses at least one but not all the physical features which would yield scientific information.

(2) Atlantic Region

PREHISTORIC RESOURCES: The existing conditions of the Atlantic prehistoric resources are described in Section IV.D.1.a(13). Possible impacts to prehistoric sites could arise from bottom-disturbing activities. The routine activities under this Alternative for the Atlantic that could impact on these sites are the laying of pipelines or conducting of drilling activities inside the 30-m isobath off most of the Atlantic coast, or inside of the 18-m isobath off North Carolina and Florida where erosion would have destroyed any prehistoric resources in deeper water (USDOI, MMS, 1990f; SAI, 1981). As noted in Section IV.D.1.a(13), prior to the commencement of any of these bottom-disturbing activities, the "Protection of Archaeological Resources" stipulation will require proof that these activities will not affect prehistoric resources.

Accidents that can disturb prehistoric sites include spilled oil and clean-up activities associated with spilled oil. Under Alternative VI, it is assumed that a small spill will occur in the vicinity of each of the support bases and at the mouth of Delaware Bay.

No impacts on prehistoric resources are expected under this Alternative. Surveys required by the "Protection of Archaeological Resources" stipulation are expected to identify buried landforms with potential for prehistoric resources. Avoidance of these areas or further proof that no prehistoric resources exist, as required by the stipulation, would prevent the loss of archaeological information. If a prehistoric resource is contacted accidentally, most of the features which give it scientific integrity are expected to remain.

Small chronic spills that could occur during supply vessel refueling typically weather or are cleaned up before they have a chance to contaminate prehistoric resources. The C^{14} datable material that may be associated with these sites is expected, therefore, to not be affected by spills of this magnitude. Those sites that could be contacted by a small diesel fuel spill would be those that are already exposed to the environment and would already have been substantially altered. Cleanup of diesel fuel spills is assumed to not involve the removal of oiled sediments since diesel fuel tends to evaporate and does not leave behind tars and asphalt. Additionally, if a spill is smaller than 12 bbl, typically neither mechanical cleanup nor dispersants are used (NAS, 1989).

HISTORIC RESOURCES: The existing conditions of the Atlantic historic resources are described in section IV.D.1.a(13). Routine activities that disturb the ocean floor would have the greatest potential for affecting historic resources. Any objects placed on the ocean floor, such as drilling rigs and anchors, can crush a fragile wooden shipwreck. Dredging and burial activities during pipeline laying activities can also destroy historic shipwrecks. As with prehistoric resources, the "Protection of Archaeological Resources" stipulation would require proof that any bottom-disturbing activities would not affect historic resources.

Accidents that can disturb prehistoric sites include spilled oil and clean-up activities associated with spilled oil. For Alternative VI, it is assumed that a small spill will occur in the vicinity of each of the support bases and at the mouth of the Chesapeake Bay.

Surveys required by the "Protection of Archaeological Resources" stipulation are expected to identify potential shipwrecks throughout most of the OCS. It is expected that the assumed pipeline to the Charleston, SC area will pass through an area approximately 30 to 40 km (18.6 to 24.9 mi) wide, where the remains of shipwrecks would most likely be buried. Survey limitations in this area may not prevent a shipwreck being contacted. If pipeline construction were to contact a historic shipwreck, much of the valuable information could be destroyed. Given the shipwreck density near Charleston and the assumed pipeline activity, it is expected that a shipwreck would be contacted. The "chance" find clause of the stipulation is expected to preserve much of the valuable information.

Small spills that could occur during supply vessel refueling will have little effect on historic shipwrecks and historic structures, even those in coastal areas. These small spills typically weather or are cleaned up before they have a chance to contact a sunken vessel or historic structure. Therefore, no impacts are expected from the small spills that are assumed to occur.

CONCLUSION: The assumed Alternative VI activities are expected to result in a historic shipwreck area being contacted by pipeline construction activities. Much of the valuable information is expected to be retained by compliance with the "chance" find clause of the "Protection of Archaeological Resources" stipulation. No impact is expected to occur to prehistoric resources.

m. Impacts on Recreation and Tourism

(1) Gulf of Mexico Region

Routine drilling and production in nearshore tracts within 10 miles of coastal park and recreation areas off the coast of Louisiana, Mississippi and Alabama will be visible from shore during fair weather conditions. Helicopters and boat traffic servicing offshore operations may also be seen and heard by recreational beach users and tourists. Pipeline construction across recreational beaches in Texas, Louisiana, and Mississippi or Alabama will remove 1,200-1,600 ft of beach shorefront from recreational use for 2-3 weeks while each landfall is under construction. Offshore platforms, especially those within 25 miles of shore will attract fish and fishermen. Accidents associated with drilling, production and transportation of gas and oil will cause pollution and debris on coastal beaches. Major oil spills are expected to lead to closure of beach and park areas along the coasts of Louisiana and Texas for up to six weeks.

CONCLUSION: The proposed alternative is expected to result in closure (less than a full season or 6 months) at a few park and recreation areas during one of the 45 years of the project life as a result of oil spills (up to a 22% probability of one or more spills of 10,000 bbl or more). Tourist losses associated with these closures will be local and represent less than 10 percent of projected economic gains. Platforms installed offshore as a result of the proposal, especially those within 25 miles of shore, will attract recreational fishermen and divers.

(2) Atlantic Region

The existing conditions for the coastal recreation and tourism industry in the Atlantic States are described in Section III.D.3.d. The assumed exploration and development scenario for Alternative VI is the same as that assumed for Alternative I. A description of the potential impacts expected to occur from these infrastructure assumptions is contained in Section IV.D.1.a(14). An oil spill of 1,000 bbl or more is not assumed to occur under this scenario.

Under this alternative to the proposed action, it is assumed that 35 exploratory and 108 development and production swells will be drilled with resupply services occurring from 2 support bases. Production of the hydrocarbon resources assumed to be discovered will require 6 production platforms, 3 gas pipelines, and 2 gas processing plants. Since these assumptions are the same as those in Alternative I, the impact on coastal recreation and tourism is expected to be the same.

Under Alternative VI, the potential for visual impact on the coastal visitor from drilling operations will be limited to the coastal county of Dare, NC. Few impacts on recreational fishing activities due to the presence of offshore drilling and production structures and their spatial exclusion zones are expected. Establishing support bases at commercial ports would not prevent use of existing coastal recreation sites or remove areas for consideration for future recreational development.

Maintenance of the gas pipelines under the scenario for Alternative VI will prevent future recreational and commercial development on the sites. It is assumed that the gas processing facilities will be built in an area of existing urban/industrial development. Therefore, access to public recreational sites is not expected to change.

CONCLUSION: Under Alternative VI, offshore operations will have a visual impact on the coastal visitor to barrier islands in North Hampton County in Virginia and Dare County in North Carolina. A permanent visual impact is also expected at the sites of the maintenance ROW for the assumed gas pipelines. Impact on public access to coastal recreation sites will be limited to the gas pipeline construction period.

7. Alternative VII — Cook Inlet/Shelikof Strait Enlargement

Alternative VII enlarges the area under consideration for leasing in Alternative I for the Cook Inlet Planning Area. In Alternative VII the potential sale area for Cook Inlet/Shelikof Strait consists of 761 blocks (see Figure II.G.1-1). Alternative VII, does not change the size, timing or location of leasing activities in the Gulf of Mexico or Atlantic OCS Regions. Resource estimates associated exploration and development, and oil spill assumptions for these two Regions remain the same as stated in Alternative I. Therefore, the impacts expected from the activities in the Gulf of Mexico and Atlantic Regions for Alternative VII are identical to the impacts described for Alternative I (see Section IV.D.1.a).

Leasing activities, resource estimates, and scenario assumptions in the Pacific Region also remain the same for Alternative VII as for the proposed action. However, the potential impacts to some migratory species that occur in both the Pacific and Alaska Regions may change under this alternative because of changes in activities assumed in the Alaska Region. Therefore, this section includes an analysis for the Alaska and Pacific Regions.

RESOURCE ESTIMATES: Resource estimates for Alternative VII are presented in Table IV.D.7-1. Section IV.D.1.a provides a discussion on the PRESTO model used to calculate the estimates of resources that are assumed to be leased, discovered, and produced.

Table IV.D.7-1. Conditional Resource Estimates — Cook Inlet/Shelikof Strait Enlargement

REGION AND PLANNING AREA	OIL (BBO)	GAS (TCF)	MPHC
GULF OF MEXICO REGION			
Western Gulf of Mexico	0.23	3.51	1.00
Central Gulf of Mexico	0.57	5.64	1.00
Eastern Gulf of Mexico	0.02	0.22	1.00
ALASKA REGION			
Beaufort Sea	0.52	—	0.16
Chukchi Sea	2.01	—	0.21
Hope Basin *or*	0.24	—	<0.01
St. George Basin	0.23	—	0.02
Norton Basin *or*	0.30	—	<0.01
St. Matthew-Hall *or*	<0.01	—	<0.01
Navarin Basin	0.24	—	0.03
Cook Inlet/Shelikof Strait	0.16	—	<0.01
Gulf of Alaska	0.34	—	0.04
PACIFIC REGION			
Southern California	0.33	1.01	1.00
ATLANTIC REGION			
Mid- and South Atlantic	0.08	2.24	0.63

BBO - Billion Barrels of Oil
TCF - Trillion Cubic Feet
MPHC - Marginal Probability of Commercial Hydrocarbons

Table IV.D.7-2. Exploration And Development Activity — Cook Inlet/Shelikof Strait Enlargement

Planning Area	Sales (No.)	BBOE	MPHC	Exp./Del. Wells (No.)	Dev./Pro. Wells (No.)	Platforms (No.)	Years Of Activity
Western Gulf of Mexico	5	.86	1.00	1000	540	50	1993-2030
Central Gulf of Mexico	5	1.58	1.00	1380	980	110	1994-2031
Eastern Gulf of Mexico	2	.05	1.00	90	40	8	1998-2036
Beaufort Sea	2	.52	0.16	12	70	3	1994-2021
Chukchi Sea	2	2.01	0.21	47	268	7	1995-2025
Hope Basin *or*	1	.24	<0.01	8	34	1	1996-2021
St. George Basin	1	.23	0.02	8	50	1	1996-2021
Norton Basin *or*	1	.30	<0.01	11	66	1	1997-2022
St. Matthew-Hall *or*	1	<.01	<0.01	6	—	—	1997-1999
Navarin Basin	1	.24	0.03	8	48	1	1997-2022
Cook Inlet/Shelikof Strait	1	.16	<0.01	8	26	1	1995-2019
Gulf of Alaska	1	.34	0.04	11	53	1	1996-2021
Southern California	1	.51	1.00	25	150	7	1998-2030
Mid- and South Atlantic	2	.48	0.63	35	108	6	1995-2024

MPHC - Marginal Probabilty Of Commercial Hydrocarbons
BBOE - Billion Barrels of Oil Equivalent

EXPLORATION AND DEVELOPMENT ASSUMPTIONS: The hypothetical scenarios concerning exploration and development activities for Alternative VII were developed using the same assumptions as in Alternative I (Section IV.D.1.a). The level of offshore and onshore activities are based on the amount of hydrocarbon resources assumed to be leased, developed, and produced as a result of sales in Alternative VII (see Tables IV.D.7-2 and IV.D.7-3).

TRANSPORTATION AND MARKET ASSUMPTIONS: The amount of natural gas and oil resources assumed to be leased and developed in the Cook Inlet/Shelikof Strait Planning Area are comparable to those of the proposal (Alternative I). Thus the basic assumptions used in Alternative I concerning how gas and oil production will be transported to shore (Section IV.D.1.a) are applicable to Alternative VII. No assumption was made concerning the amounts of natural gas and oil that would be foregone as a result of the adoption of Alternative VII.

OIL SPILL ASSUMPTIONS:

Oil Spills Greater Than or Equal to 1,000 bbl. Table IV.D.7-4 presents the number and type of oil spills assumed to occur as a result of OCS activity associated with Alternative VII. The source and number of assumed spills were based on the volume of oil listed in Table IV.D.7-1, and assumptions on the mode of transportation and spill rates for spills greater than or equal to 1,000 bbl (see Section IV.D.1.a).

Table IV.D.7-5 presents the probabilities of one or more spills of 1,000 bbl or greater and 10,000 bbl or greater occurring. These probabilities are based on the total estimated mean number of spills assumed to occur as a result of oil production from the adoption of Alternative VII. It is also assumed that these spills would occur with uniform frequency over the life of the alternative.

Table IV.D.7-6 presents the assumed location of tanker spills along the tanker routes. Tanker spills resulting from production in the Beaufort and Chukchi Sea Planning Areas are assumed to occur

Table IV.D.7-3. New Offshore and Onshore Infrastructure — Cook Inlet/Shelikof Strait Enlargement

Planning Area	Platforms (No.)	Oil and Gas Pipelines[3,6,7,8] (No.)	Oil and Gas Pipelines [7,9] (Miles)	Pipeline Landfalls (No.)	Shore Bases/ Support Facilities (No.)
Western Gulf of Mexico	50	–	1020	2	2[1]
Central Gulf of Mexico	110	–	1240	2	2[2]
Eastern Gulf of Mexico	8	–	445	–	–
Beaufort Sea	3	–[4]	275	1	1[5]
Chukchi Sea	7	–[4]	250	1	1[5]
Hope Basin *or*	1	1	90	1	1[5]
St. George Basin	1	–	–	–	1[5]
Norton Basin or	1	–	–	–	–[5]
St. Matthew-Hall *or*	–	–	–	–	1
Navarin Basin	1	–	–	–	–
Cook Inlet/Shelikof Strait	1	1	25	1	1[5]
Gulf of Alaska	1	1	100	1	1[5]
Southern California	7	14	50	–	–
Mid- and South Atlantic	6	3	580	3	6[10]

1. Gulf of Mexico Region - additional support facilities: 2 new marine terminals.
2. Gulf of Mexico Region - additional support facilities: 1 new marine terminal and 1 new pipeline yard.
3. Alaska Region - oil pipelines only.
4. Alaska Region - offshore gathering system.
5. Shorebases can include tank farms, docks, air bases, utilities, supply depots and personnel quarters.
6. Pacific Region - total number of oil and gas pipelines.
7. Pacific and Gulf of Mexico Regions - oil and gas pipelines are layed along the same pipeline corridor.
8. Atlantic Region - gas pipelines only.
9. Atlantic Region - total pipeline miles includes gathering and trunk lines.
10. Atlantic Region - additional support facilities: 2 new gas plants, 2 new heliports and 2 supply bases.

outside of those planning areas. Oil produced in the Beaufort and Chukchi Sea Planning Areas would be transported by the TAPS to the Valdez terminal facilities and then transported by tanker to west coast ports. Based on the destination and amount of the TAPS oil shipped from Valdez to west coast ports (Puget Sound, Washington; San Francisco and Los Angeles, California), it is reasonable to assume that a tanker spill should occur along the tanker route to these ports.

The probabilities of one or more pipeline or platform spills equal to or greater than 1,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 46 percent and 92 percent, respectively. The probabilities of one or more pipeline or platform spills equal to or greater than 10,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 19 percent and 57 percent, respectively. As a result of the transportation of oil from the Chukchi Sea Planning Area, there is a 93-percent probability of one or more spills of 1,000 bbl occurring and a 81-percent probability of one or more spills of 10,000 bbl or greater occurring. As a result of the transportation of oil from the Beaufort Sea Planning Area, there is a 46-percent probability of one or more spills occurring and a 36-percent probability of one or more spills of 10,000 bbl or greater occurring.

Table IV.D.7-4. Oil Spill Assumptions — Cook Inlet/Shelikof Strait Enlargement

Planning Area	Assumed Oil Spills[3] Platform (Nos.)	Pipeline (Nos.)	Tanker (Nos.)
Western Gulf of Mexico	–	1	–
Central Gulf of Mexico	1	1	–
Eastern Gulf of Mexico[1]	–	–	–
Beaufort Sea	–	1	1
Cukchi Sea	1	2	3
Hope Basin *or*	–	–	1
St. George Basin	–	–	1
Norton Basin *or*	–	–	1
St. Matthew-Hall[2] *or*	–	–	–
Navarin Basin	–	–	1
Cook Inlet/Shelikof Strait	–	–	1
Gulf of Alaska	–	–	1
Southern California	–	1	–
Mid-and South Atlantic[1]	–	–	–

1. No spill was assumed — total estimated mean number of spills was 0.14 - Mid- and South Atlantic; 0.03 - Eastern Gulf of Mexico
2. No spill was assumed — exploration activity only.
3. Based on the total estimated mean number of spills greater than or equal to 1,000 bbl.

Table IV.D.7-5. Oil Spill Probabilities — Cook Inlet/Shelikof Strait Enlargement

Planning Area	Oil (BBO)	MP_{HC}	Probability of 1 or more spills occurring 1,000 bbl or greater	10,000 bbl or greater
Western Gulf of Mexico	0.23	1.00	28%	10%
Central Gulf of Mexico	0.57	1.00	52%	22%
Eastern Gulf of Mexico	0.02	1.00	3%	< 1%
Beaufort Sea	0.52	0.16	73%	48%
Chukchi Sea	2.01	0.21	**%	96%
Hope Basin *or*	0.24	<0.01	47%	27%
St. George Basin	0.23	0.02	34%	21%
Norton Basin *or*	0.30	<0.01	41%	25%
St. Matthew-Hall *or*	<0.01	<0.01	—	—
Navarin Basin	0.24	0.03	34%	21%
Cook Inlet/Shelikof Strait	0.16	<0.01	34%	18%
Gulf of Alaska	0.34	0.04	59%	34%
Southern California	0.33	1.00	34%	14%
Mid-and South Atlantic	0.08	0.63	13%	7%

**probability of one or more spills occurring is greater than 99.5%
BBO - Billion Barrels of Oil

Table IV.D.7-6. Oil Spill Assumptions — Cook Inlet/Shelikof Strait Enlargement Assumed Location of Tanker Spills

Location of the Tanker Spill Planning Area	Assumed Tanker Spills (Nos.)
Hope Basin *or*	1
St. George Basin	1
Norton Basin *or*	1
Navarin Basin	1
Cook Inlet	1
Gulf of Alaska	2
Washington and Oregon	1
Northern California	1
Southern California	1

Oil Spills Greater Than 1 bbl and Less Than 1,000 bbl. Table IV.D.7-7 presents the estimated mean number of spills assumed to occur as a result of the adoption of Alternative VII. Section IV.D.1.a presents the assumptions used in the calculation of small spills.

Table IV.D.7-7. Small Spill Assumptions — Cook Inlet/Shelikof Strait Enlargement

Planning Area	Assumed Small Spills >1≤50 bbl[1]	Assumed Small Spills >50<1,000 bbl[2]
Western Gulf of Mexico	31	1
Central Gulf of Mexico	77	3
Eastern Gulf of Mexico	3	–
Beaufort Sea	132	5
Chukchi Sea	515	21
Hope Basin *or*	61	2
St. George Basin	58	2
Norton Basin *or*	76	3
St. Matthew-Hall *or*	–	–
Navarin Basin	61	2
Cook Inlet/Shelikof Strait	41	2
Gulf of Alaska	86	3
Southern California	24	1
Mid-and South Atlantic	20	1

Small Spills Rates per billion bbls of oil produced:

1. Gulf of Mexico Region - 135; Alaska and Atlantic Regions - 253.63; Pacific Region - 72.65
2. Gulf of Mexico Region - 5 ; Alaska and Atlantic Regions - 10.25; Pacific Region -2.14

a. Impacts on Water Quality

(1) Alaska Region

Routine activities and accidental events associated with Alternative VII generally would be at the same level as Alternative I. The only impact-producing agent to differ between the scenario for this alternative and the proposed action is the addition of two exploration wells. Under the scenario, no oil spills are assumed to result from drilling these wells. Because the location of these impact-producing agents is not specified in the scenario, the impact analysis is done on an areawide basis.

The additional exploration wells would not change the areawide water-quality analysis for the proposed action. The additional exploration wells would increase the amount of muds and cuttings that would be discharged into Cook Inlet waters. However, the areawide analysis for Alternative I indicates that less than 1 percent of the planning area's water would have degraded water quality. The discharges from the two additional exploration wells under this alternative would not invalidate this areawide analysis. No changes to the effects on water quality described in Alternative I are anticipated for this alternative.

CONCLUSION: Based on the scenario for Alternative VII, trace-metal and oil and grease concentrations in discharges are not expected to exceed water-quality criteria outside a 100 meter radius around each drill site or production platform. This reduction in water quality would exist only during periods of actual discharge and would rapidly dissipate on completion of the discharge. Water quality over areas up to several thousand square kilometers could be reduced by hydrocarbon contamination for a short period of time (about 30 days). The principal cause of impacts is spilled oil, and the probability of one or more spills of 10,000 bbl or greater occurring ranges from 18 percent in Cook Inlet to 57 percent in the Chukchi Sea over the 30-year life of the proposal.

(2) Pacific Region

Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Consequently, impacts on water quality in the Pacific Region would remain unchanged from Alternative I. Section IV.D.1.a(1) provides a discussion of potential impacts on water quality in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine operational effluents include 1) formation, or produced water; 2) drilling muds and cuttings; and 3) other routine discharges such as ballast water, cooling water, desalinization brine, excess cement, deck drainage, and treated sewage. Resuspension of bottom sediments will also occur during most routine operations. Effluents and resuspended sediments resulting from routine activities in the Pacific Region are expected to cause some mortality of marine organisms within 300 to 500 m of discharge sites and elevated levels of contaminants and turbidity above ambient levels within 1,000-2,000 m.

Four oil spills of 1,000 bbl or more are assumed to occur in the Pacific Region under this alternative: one off the coast of Washington, one off northern California, and two off southern California. Accidental oil spills are expected to elevate hydrocarbon levels up to 100+ug/l and to limit water use in areas of 1,000-2,000 km^2 over a period of several days to weeks.

CONCLUSION: Based on the scenario for Alternative VII, it is expected that degraded water quality and water use would occur over areas of a few thousand km^2 for periods of days to weeks. Accidental oil spills are expected to be the major cause of impacts. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is a up to 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

b. Impacts on Air Quality

(1) Alaska Region

Routine activities and accidental events associated with Alternative VII generally would be at the same level as Alternative I. The only impact-producing agent to differ between the scenario for Alternative I and this alternative is the addition of two exploration wells in some part of the enlarged area. Exploratory wells are of short duration (1-2 seasons) and, under the scenario for the alternative, no large oil spills from them are assumed to occur. The additional exploration wells would not change the areawide air-quality analysis for the Alaska Region.

Estimates of routine-activity emissions that could affect onshore ambient air quality are based on fuel consumption from diesel engines and turbine generation of shipboard and platform electricity. Electricity consumption primarily is based on the number of exploration, delineation, and production wells and their depth and the annual oil-production rate. This information is used to prepare an estimate of annual emissions of criteria pollutants for the peak year of exploration development and production phases for Alternative I. The addition of only two exploration wells will not result in a measurable difference between the analysis for Alternative VII in comparison of emissions with Alternative I. The analysis for Alternative I is discussed in Section IV.D.1.a(2).

Potential accidental emissions are discussed in the scenario for Alternative I. Potential accidental emissions for Alternative VII would be about the same as for the scenario for Alternative I. The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last a short period after emissions cease.

CONCLUSION: Based on the scenario for Alternative VII, the NO_x emissions for diesel engines (during exploration) are expected to result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.16 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. The SO_2 and VOC from accidents are expected to be less than from normal operations and last less than a week after emissions cease.

(2) Pacific Region

Under the scenario for Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Consequently, impacts on air quality in the Pacific Region would remain unchanged from Alternative I. Section IV.D.1.a(2) provides a discussion of potential impacts on air quality in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

The effects of emissions associated with the seven platforms on acid deposition are expected to be negligible. This is based on the expected rate of emissions of NO_2 and SO_2. These emissions are only a small fraction of existing emissions of those pollutants in the southern California area.

It is assumed that one pipeline spill of an estimated 7,000 bbl of oil will occur as a result of the Alternative VII. An event such as this would have the potential to create air quality problems in the vicinity of the spill for the duration of the spill. However, onshore effects are highly dependent on the distance offshore, and weather conditions at the time. Spills greater than 3 miles from shore are unlikely to have long term, measurable effects on onshore air quality.

Three tanker spills of 30,000 bbl each are assumed to occur along the tanker route in the Pacific Region from Alaskan production. In the event of a tanker spill, total emissions for each spill during the first and second hour would be 1,710,000 lbs and 870,000 lbs respectively. In the event the spill occurs nearshore, impacts to the Washington and southern California areas could result in short-term exceedance of the onshore standard. Effects would not be discernable for the spill off northern California since it is assumed to be further offshore.

CONCLUSION: Given the scenario for Alternative VII, this alternative is expected to result in emissions of NO_x, and RHC, which cause localized increases in O_3 concentrations since routine activities remain the same as in Alternative I in the southern California planning area. These increases are estimated to be less than 5 percent of the existing onshore emissions. However, the status of the onshore counties as nonattainment for ozone and implementation of the new Clean Air Act are likely to result in a requirement for total offsets of all RHC and NO_x emissions produced. The result will be no net increase in the levels of air pollution emissions within the Pacific OCS Region Planning Area.

In the event of an accidental spill, local air quality standards off the Washington and southern California planning areas in the vicinity of the spill will be temporarily exceeded. These exceedances are expected to last for the duration of a spill, but are not expected to result in long term effects to onshore air quality.

c. Impacts on Marine Mammals

(1) Alaska Region

(a) Threatened or Endangered Species

1) Cetaceans

a) Bowhead Whale

General and specific impacts expected to be experienced by the bowhead whale from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers, if any, of this species in the enlarged area within Cook Inlet included in Alternative VII, the impact expected on bowhead whales are expected to be the same as those described for Alternative I.

CONCLUSION: Based on the assumptions for Alternative VII, it is expected that there would be sublethal effects on up to 40 percent of the bowhead whale population per year due to noise and up to 20 percent of the population due to oil spills. There is an 18 to 57 percent chance that one or more oil spills of 10,000 bbl or greater will occur throughout the range of the bowhead whale over the 30-year life of the proposal. None of these sublethal effects are expected to affect recruitment or distribution of the species.

b) Fin and Humpback Whales

Fin and humpback whales feed in the lower Cook Inlet (generally south of the Barren Islands) and Shelikof Strait in the summer months. However, these species are widely distributed throughout the southern Bering Sea and the Gulf of Alaska during this time. Based on their distribution and the estimated level of potential activity in the Lower Cook Inlet and Shelikof Strait areas, Alternative VII is estimated to have similar effects on these species as Alternative I. The effects of industrial noise and crude oil on cetaceans are minor and short term and were discussed in Section IV.D.1.a(3).

CONCLUSION: Based on the assumptions made for Alternative VII, noise is estimated to have sublethal effects on up to 20 percent per year of fin and humpback whale populations. The assumed tanker oil spills are expected to have sublethal effects on up to 10 percent of fin and humpback populations. None of the above sublethal effects are expected to affect recruitment or distribution of these species.

c) Right, Blue, Sei, and Sperm Whales

Sei whales feed in the lower Cook Inlet (generally south of the Barren Islands) and Shelikof Strait in the summer months. However, this species is widely distributed throughout the southern Bering Sea and the Gulf of Alaska during this time. Based on their distribution, and the estimated level of potential activity in the Lower Cook Inlet and Shelikof Strait areas, the activities associated with Alternative VII are estimated to have similar effects on this species as those of Alternative I. The effects of industrial noise and crude oil on cetaceans are minor and short term, and were discussed in Section IV.D.1.a(3).

CONCLUSION: Based on the assumptions made for Alternative VII, noise is expected to have sublethal effects on up to 5 percent of the sei whale population. The assumed tanker oil spills are expected to have sublethal effects on up to 5 percent of the sei whale population. None of the above sublethal effects are expected to affect recruitment or distribution of this species.

2) Pinnipeds

STELLER SEA LION: General and specific impacts expected to be experienced by the Steller sea lion from activities occurring in the Cook Inlet/Shelikof Strait area as originally proposed are included in Alternative I analysis (Section IV.D.1.a). The enlargement of this proposed sale area results in the addition of two exploration wells. More importantly, the enlargement incorporates nearly all of the Shelikof Strait area soon to be proposed as critical habitat for sea lions under the Endangered Species Act. Shelikof Strait is a primary foraging area for sea lions occupying the western Gulf of Alaska. Because development potentially could occur at any point in the proposed area, this alternative places at risk four rookeries and 13 haulouts adjacent to the proposed area (2 rookeries and 7 haulouts lie adjacent to sale areas proposed in Alternative I) plus two rookeries and six haulouts on eastern Kodiak and Afognak Islands and the Kenai Peninsula. All of these sites are to be proposed as critical sea lion habitat.

Although substantial adult mortality is not expected to occur as a result of oil-spill contact, reduced survivorship of considerable pups and juveniles is likely to result if contact occurs during the summer season, potentially accelerating the current population decline. Enlargement of the proposed sale area is expected to elevate this potential by placing a greater proportion of the population, including important rookeries, at risk. Also of concern is the increased potential for support helicopter and vessel traffic and spill-cleanup activities to disrupt reproductive activities and foraging. Although these adverse effects may not elevate the overall impact of Alternative VII significantly above that indicated for Alternative I, the probability of occurrence is expected to increase. Under Alternative VII, with its potential exposure of a correspondingly greater proportion of the Steller sea lion population to disturbance and oil spill risk (approximately 30% vs. 15% under Alternative I), is expected to elevate the probability of occurrence of impacts on the population as originally proposed under Alternative I.

CONCLUSION: Based on the scenario for Alternative VII, and given the recent rapid decline in sea lion numbers in Alaska, is expected to increase the probability that extended recovery interval as proposed under Alternative I (more than 3 generations or 18 plus years), will be required to return the sea lion population to its initial status.

(b) Nonendangered Species

1) Cetaceans

a) Beluga Whale

The increase in oil and gas exploration activities in the proposed Cook Inlet Planning Area from six to eight exploration wells and the increase in the lease tract area shown on Figure II.G.1-1 is not expected to greatly increase potential oil-spill and noise-disturbance effects on beluga whales. This is because the beluga whale population ranges throughout the entire planning area and would be equally exposed to potential noise disturbance from oil and gas activities regardless of where it occurs. Potential oil spills in the proposed lease area have about an equal chance of contacting belugas or their habitats regardless of whether the tract area is expanded or not.

CONCLUSION: Under Alternative VII, the primary effects on beluga whales are expected to come from noise and disturbance, especially icebreaking activities, and other marine-vessel traffic and oil spills. Noise and disturbance from icebreakers and other marine traffic are expected to temporarily (a few days to less than 3 years) displace or interfere with beluga whale movements within a few to several miles of the activities. Few beluga whales are likely to die from contact with the oil spills.

The loss of beluga whales from the assumed oil spills (perhaps 10 whales or less) in the Alaskan populations is expected to be less than the losses due to natural mortality such as losses from disease, predation, and subsistence harvest. There is an 18 to 57 percent chance of one or more spills of 10,000 bbl or greater occurring throughout the range of the beluga whale over the 30-year life of the proposal.

b) Minke Whale

Under the scenario for Alterative VII, the types and amounts of routine activities and accidental events are generally at the same as for Alternative I. The only impact-producing agent to differ between the scenario for this alternative and that for Alternative I is the addition of two exploration wells somewhere in Cook Inlet. The increase in exploration wells is not expected to cause a measurable change in the potential impacts analyzed under Alternative I (Section IV.D.1.a). No large oil spills are assumed to result from drilling these wells. Section IV.D.1.a provides an analysis of the potential impacts on the minke whale population and the impacts expected as a result of implementing Alternative I.

CONCLUSION: Based on the scenario for Alternative VII, the adoption of the alternative is expected to displace minke whales from a few square kilometers of summer feeding areas in the Alaska Region as the result of exploration and development activity over the life of the alternative, but are not expected to disrupt minke whale movements through the Alaska and Pacific Regions. No minke whale mortality is expected as a result of accidental oil spills. Any changes in numbers or distribution as a result of displacement from the area of an oil spill are expected to last no more than a few months. The probabilities of one or more oil spills of 10,000 bbl or greater occurring in the Alaska and Pacific Regions range from 14 to 81 percent.

2) Pinnipeds

a) Northern Fur Seal

General and specific impacts expected to be experienced by the northern fur seal from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers, if any, of this species in the enlarged area within Cook Inlet included in this alternative, the analysis and conclusions are expected to be the same as described for Alternative I.

CONCLUSION: Disturbance associated with the scenario for Alternative VII is expected to result in some loss of fur seal productivity and elevated pup mortality. Where fur seals are relatively concentrated, in the vicinity of the Pribilof Islands in summer and fall, during peak passage of migrants through Unimak Pass and at San Miguel Island during the breeding season, oil spills associated with Alternative I are expected to result in losses (probably exceeding 5,000 individuals) requiring three or more generations (12 plus years) for recovery. Where densities are substantially lower farther from the islands, along the migration route, and in wintering areas, mortality experienced by this species is expected to be less and thus require only a generation (4-6 years) for the population to return to its initial status. There is an 18 to 34 percent probability that one or more oil spills of 10,000 bbl or greater will occur in the planning areas occupied by fur seals over the life of the proposal.

b) Ice Seals

General and specific impacts expected to be experienced by the ice seal from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers, if any, of this species in the enlarged area within Cook Inlet included in this alternative, the analysis and conclusions are expected to be the same as presented for Alternative I.

CONCLUSION: Under the scenario for Alternative VII, helicopter flights and vessel traffic associated with this alternative are not expected to disturb a major proportion of the seal populations or result in substantial effects on their distribution or migration. There is a 22 to 57 percent chance of one or more spills of 10,000 bbl or greater occurring throughout the range of the ice seal over the

30-year life of the alternative. Although oil spills assumed for to occur under Alternative VII could result in some mortality among newborn or severely stressed adult ice seals, such incidents are not expected to cause losses exceeding a few hundred individuals out of a total estimated population of probably 1 to 2 million ice seals or that could not be replaced within a generation (4 to 7 years).

c) Harbor Seal

General and specific impacts expected to be experienced by the harbor seal from activities occurring in the Cook Inlet/Shelikof Strait area are included in the analysis for Alternative I (See Section IV.D.1.a). Under Alternative VII, the enlargement of the potential Cook Inlet sale area relative to the proposed action results in the addition of two exploration wells. More importantly, the enlargement incorporates southern Shelikof Strait and southern Cook Inlet, where major western Gulf of Alaska harbor seal haulout/pupping areas are located. Because development potentially could occur at any point in the proposed area, this alternative places at risk an important pupping area in the western gulf (Tugidak Island) and 11 major (and numerous minor) haulouts adjacent to the proposed area (3 major haulouts lie adjacent to sale areas proposed in Alternative I). Numbers of seals occupying Tugidak Island have declined by 75 percent since the mid-1960's (Pitcher, 1990), and the population on both sides of the Alaska Peninsula appears to be declining.

Although substantial adult mortality is not expected to occur as a result of oil-spill contact, reduced survivorship of pup juvenile is likely to result if contact occurs during the summer season, potentially accelerating the current population decline. Enlargement of the proposed sale area is expected to place a greater proportion of the population, including important pupping areas, at risk. Also of concern is the increased potential for support helicopter and vessel traffic and spill-cleanup activities to disrupt reproductive activities and foraging. Although these adverse effects may not elevate the overall potential impact of Alternative VII significantly above that indicated for Alternative I, the probability of occurrence is expected to increase.

CONCLUSION: Enlargement of the proposed Cook Inlet/Shelikof Strait sale area under Alternative VII, with its potential exposure of a correspondingly greater proportion of the western Gulf of Alaska harbor seal population to disturbance and oil spill risk (approximately 5% vs. 1% under Alternative I), is expected to elevate the probability of occurrence of impacts on the population relative to Alternative I. As a result, and given the recent decline in harbor seal numbers in Alaska, this alternative is expected to increase the probability that a recovery interval as proposed under Alternative I (no more than one generation or 5 years) will be required to return the harbor seal population to its initial status.

d) Pacific Walrus

General and specific impacts expected to be experienced by the pacific walrus from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers, if any, of Pacific walrus in the enlarged area within Cook Inlet included in this alternative, the analysis and conclusions are expected to be the same as presented for Alternative I.

CONCLUSION: Based on the assumed oil spills for the Alternative VII scenario, adult walruses are expected to experience few fatalities unless they are otherwise severely stressed (e.g., disease, starvation). Calves, however, could experience fatal effects from contact or ingestion of oil or trampling. Population effects resulting from oil spills (probably not involving mortality greater than 200 individuals) are not expected to require more than one generation (10 years) for recovery. There is up to a 57 percent chance of one or more spills of 10,000 bbl or greater occurring throughout the range of the Pacific walrus over the 30-year life of the alternative. Effects of disturbance from routine activities are not expected to be sufficiently adverse to elevate the aggregate effect of oil spills plus disturbance substantially above that for oil spills alone.

3) Sea Otter (Alaska Population)

General and specific impacts expected to be experienced by the sea otter from activities occurring in the Cook Inlet/Shelikof Strait area are included in the analysis for the proposed action (Section IV.D.1.a). The enlargement of the potential Cook Inlet sale area results in the assumption that two additional exploration wells would be drilled. More importantly, the enlargement incorporates areas adjacent to Kodiak Island and the Kenai Peninsula where perhaps 10,000 sea otters are resident. Because development potentially could occur at any point in the proposed area, this alternative places at risk approximately 6 percent of the Alaska population (perhaps 4% is resident in areas adjacent to the areas proposed in Alternative I).

Substantial adult and pup mortality is expected to occur as a result of any oil-spill contact, and enlargement of the proposed sale area is expected to increase this potential by placing a greater proportion of the population at risk. Also of concern is the increased potential for support helicopter and vessel traffic and spill-cleanup activities to disrupt reproductive activities and foraging. Although these adverse effects may not elevate the overall impact of Alternative VII significantly above that indicated for Alternative I, the probability of occurrence is expected to increase.

CONCLUSION: Enlargement of the proposed Cook Inlet/Shelikof Strait sale area under Alternative VII, with its potential exposure of a correspondingly greater proportion of the western Gulf of Alaska sea otter population to disturbance and oil spill risk (approximately 6% vs. 4% under Alternative I), is expected to elevate the probability of occurrence of impacts on the population as originally proposed under Alternative I. As a result, this alternative is expected to increase the probability that a recovery interval as proposed under Alternative I (two generations or more, generation equals 3 to 5 years) will be required to return the sea otter population to its initial status.

4) Polar Bear

General and specific impacts expected to be experienced by the polar bear from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers, if any, of this species in the enlarged area within Cook Inlet included in this alternative, the analysis and conclusions are expected to be the same as presented for Alternative I.

CONCLUSION: Based on the oil spill assumptions for Alternative VII, the alternative is expected to cause pathological conditions and mortality in polar bears of up to 25 individuals requiring no more than one generation (5 years) for recovery over the major proportion of their range where densities are low. However, these effects are expected to involve many more individuals where bears are concentrated near abundant prey, and result in losses requiring a generation or more for the population to return to its initial status. The probability of one or more spills of 10,000 bbl occurring in the planning areas where polar bears are located ranges from 21 percent to 57 percent over the 30-year life of the proposal.

(3) Pacific Region

(a) Threatened or Endangered Species

1) Cetaceans

GRAY WHALE: Under Alternative VII, the proposed action in the Pacific remains unchanged from Alternative I. Section IV.D.1.a(3) provides a discussion of potential impacts on the gray whale population and an analysis of the impacts expected as a result of Alternative I.

CONCLUSION: The adoption of Alternative VII is expected to result primarily in sublethal effects on the gray whale population involving changes in abundance and distribution lasting a year or less. A few mortalities will occur due to accidental oil spills. This level of mortality is not expected to be distinguishable from natural variability within the gray whale population. There is a 14 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the gray whale over the 30-year life of the alternative.

2) Pinnipeds

GUADALUPE FUR SEAL: Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to the Guadalupe fur seal would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the Guadalupe fur seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on Guadalupe fur seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the Guadalupe fur seal population.

Two spills of 1,000 bbl or more are assumed to occur off southern California under this alternative. Since a small, undetermined number of Guadalupe fur seals are probably present in these waters at any one time, it is possible that such a spill would contact and kill a few individual fur seals. This level of mortality would not be distinguishable from natural variability within the population.

CONCLUSION: Adoption of Alternative VII is expected to have no discernable effect on Guadalupe fur seal abundance and distribution.

3) Sea Otter (Pacific Population)

Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to the California and Washington sea otter populations would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the sea otter populations in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea otters include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Routine operations associated with the proposed action are not expected to impact the California or Washington sea otter populations.

Three oil spills of 1,000 bbl or more are assumed to occur in the Pacific Region and to contact the shoreline under this alternative: one off the coast of Washington, and two off southern California. An oil spill of this size contacting the sea otter populations in either of these areas would result in mortality and temporary loss of habitat. Assuming a pipeline spill and contact to the California mainland range, the death of up to 250 sea otters is expected, and recovery of the California sea otter population would take up to 3 years. Assuming a spill and contact to San Nicolas Island, the translocated sea otter population would probably be eliminated. Assuming a spill and contact to the Washington range, tens of otters would die, and recovery of the Washington sea otter population would possibly take more than 5 years.

CONCLUSION: Adoption of Alternative VII is expected to have lethal effects on sea otter populations in the Pacific Region. Sea otter mortality is expected to occur as the result of accidental oil spills; population recoveries will take 3 years or more. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is a up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Nonendangered Species

1) Cetaceans

a) Killer Whale

Under Alterative VII, routine activities and accidental events are generally at the same level as Alternative I. The only impact-producing agent to differ in this scenario from that of Alternative I is the addition of two exploration wells. The increase in exploration wells is not expected to cause a measurable change in the potential impacts analyzed under Alternative I (Section IV.D.1.a). No additional oil spills are anticipated from these wells. Section IV.D.1.a provides a discussion of the potential impacts on the minke whale population and an analysis of the impacts expected as a result of Alternative I.

CONCLUSION: Routine activities from Alternative VII are expected to have no measurable effects on the killer whale population. The major impacting factor is expected to be spilled oil. Assuming a spill occurrence and contact, oil spills are expected to result in the death of a few killer whales in protected Alaskan waters. This level of mortality is expected to be indistinguishable from natural variability within the killer whale population. There is a 34 percent probability that one or more oil spills of 10,000 bbl or greater will occur from production in the Gulf of Alaska. There is also up to an 81 percent probability that one or more oil spills of 10,000 bbl or greater will occur along the tanker route.

b) Harbor Porpoise

Under Alterative VII, routine activities and accidental events are generally at the same level as Alternative I. The only impact-producing agent to differ in this scenario from that of Alternative I is the addition of two exploration wells. The increase in exploration wells is not expected to cause a measurable change in the potential impacts analyzed under Alternative I (Section IV.D.1.a). No additional oil spills are anticipated from these wells. Section IV.D.1.a provides a discussion of the potential impacts on the harbor porpoise population and an analysis of the impacts expected as a result of Alternative I.

CONCLUSION: Under Alternative VII, routine exploratory and development activities are expected to result in the displacement of harbor porpoises from a few square kilometers of nearshore habitat in Cook Inlet and the Gulf of Alaska for a period of several months during pipeline construction. The major impacting factor is expected to be spilled oil. Assuming occurrence and contact oil spills are expected to result in the loss of a few harbor porpoises and the possible displacement of animals from the area of the spill for several months. This level of mortality is expected to be indistinguishable from natural variability in the harbor porpoise population. The probabilities of one or more spills of 10,000 bbl or greater occurring in harbor porpoise areas in Alaska and along the Washington coast range from 18 to 81 percent.

2) Pinnipeds

a) Northern Elephant Seal

Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to the northern elephant seal would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the northern elephant seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on elephant seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the northern elephant seal population.

If one of the oil spills assumed to occur off southern California under this alternative were to contact the rookery beaches on San Miguel or San Nicolas Island during the species' winter breeding season, some pup mortality could occur. Assuming occurrence and contact, accidental oil spills are expected to result in the death of a few (less than 20) elephant seal pups. This level of mortality would not be distinguishable from natural variability within the elephant seal population.

CONCLUSION: Adoption of Alternative VII is expected to result primarily in sublethal effects on the northern elephant seal population. A few mortalities (less than 20) are expected to occur due to accidental oil spills. No discernable changes will occur in northern elephant seal abundance or distribution.

b) California Sea Lion

Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to California sea lions would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts on the California sea lion population and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on California sea lions include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact the California sea lion population.

Two oil spills of a 1,000 bbl or more are assumed to occur off southern California under this alternative. An oil spill of 1,000 bbl or more contacting a California sea lion rookery during the species' summer breeding season would result in pup mortality. Assuming a spill during the summer and contact to one of the rookeries, it is possible that tens to hundreds of sea lion pups would die. Recovery of the California sea lion population from such a loss is expected to take 3 years or less.

CONCLUSION: Adoption of Alternative VII is expected to result primarily in sublethal effects on the California sea lion population. Some mortality (of tens to hundreds of pups) is expected to occur due to accidental oil spills. Population recovery will take no more than 3 years. No discernable changes in California sea lion distribution will occur. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative.

d. Impacts on Terrestrial Mammals

ALASKA REGION: Caribou. General and specific impacts expected to be experienced by the caribou from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(4). Effects were anticipated mainly from pipeline construction, and the level of this activity remains the same in this alternative; the analysis and resulting conclusion will remain the same as described in Alternative I.

CONCLUSION: Disturbance from construction and operation of facilities, as well as air and vehicle traffic, associated with the scenario for Alternative VII is expected to cause displacement of portions of North Slope caribou herds with the animals avoiding substantial parts of the core calving areas for the life of the project. The resulting reduction in caribou distribution or abundance (fewer than 100) is not expected to require more than two generations (3 to 5 years per generation) for recovery. Oil spills are expected to have little impact on caribou.

e. Impacts on Marine and Coastal Birds

(1) Alaska Region

(a) Threatened or Endangered Species

1) Arctic and American Peregrine Falcons

General and specific impacts expected to be experienced by the Arctic and American peregrine falcon from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(5). Because of the wide distribution and low population density of this species, the analysis and resulting conclusion for Alternative VII will remain the same as described in Alternative I.

CONCLUSION: Under Alternative VII, noise associated with hypothesized activities is estimated to lead to abandonment of up to 50 percent of the peregrine falcon nest sites, and cause a reduced rate (up to 50 percent) of reproduction. Assuming that one or more of the assumed oil spills assumed under the alternative contacts feeding areas for peregrine falcons, the spills would indirectly affect from up to 50 percent of the peregrine falcon population in Alaska and would result in up to 50 percent mortality. This decline in species numbers would last longer than 5 years. There is an 18 to 57 percent chance of one or more spills of 10,000 bbl or greater occurring in Alaska over the 30-year life of the alternative.

2) Short-Tailed Albatross

General and specific impacts expected to be experienced by the short-tailed albatross from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(5). Because of the relatively small percent of the population of this species in this alternative area, the analysis and resulting conclusion for Alternative VII will remain the same as described in Alternative I.

CONCLUSION: Under Alternative VII, oil spills could affect up to 25 percent of the population depending on the number of birds present in the area of the oil spill. The probability of an oil spill of 10,000 bbl or greater occurring in the habitat of the short-tailed albatross ranges from 18 to 81 percent.

(b) Nonendangered Species

1) Bald Eagle (Alaska Population)

General and specific impacts expected to be experienced by the bald eagle from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(5). Because of the relative small percent of the population of this species in this alternative area, the analysis and resulting conclusion will remain the same as described in Alternative I.

CONCLUSION: Under Alternative VII, routine activities associated with the development scenario are expected to disturb fewer than 25 pairs of nesting eagles and require the equivalent of one generation (minimum of 5 years) for recovery of any loss in productivity. The assumed tanker oil spills in the Gulf of Alaska, where the bald eagle population is concentrated, are expected to cause mortality potentially involving a loss of 50 to 75 individuals requiring a minimum of three generations (15 years) for recovery. There is an 18 to 34 percent probability of one or more oil spills of 10,000 bbl or greater occurring due to OCS activities in the Cook Inlet and Gulf of Alaska Planning Areas over the 30-year life of the alternative.

CONCLUSION: Under Alternative VII, oil spills could affect between 1 and 25 percent of the population depending on the number of birds present in the spill area.

2) Waterfowl

General and specific impacts expected to be experienced by waterfowl from activities occurring in the Cook Inlet/Shelikof Strait area originally proposed are included in the proposal analysis (Section IV.D.1.a). The enlargement of this proposed sale area results in the addition of two exploration wells. More importantly, the enlargement lies adjacent to important waterfowl wintering and migration staging areas including Kodiak Island, the Alaska Peninsula, Lower Cook Inlet, and the Kenai Peninsula. Because development potentially could occur at any point in the proposed area, this alternative places at risk tens to hundreds of thousands of wintering or migrating ducks and geese in fall, winter, and spring. During the breeding season, the entire population of tule white-fronted geese nests in Redoubt Bay in Cook Inlet 20 to 30 miles north of the northernmost part of lease area.

Enlargement of the proposed sale area is expected to place a greater proportion of these populations at risk. Also of concern is the increased potential to disrupt foraging activity which, in turn, may adversely affect migration and reproduction. These potential adverse effects are expected to elevate the overall impact of Alternative VII somewhat above that indicated for Alternative I (e.g., losses requiring no more than one generation, 2-4 years, for recovery to original population status), except in cases of restricted distribution such as the tule goose, which would require a longer interval.

CONCLUSION: Enlargement of the proposed Cook Inlet/Shelikof Strait sale area under Alternative VII, with its potential exposure of a correspondingly greater proportion of wintering or migrating ducks and geese than Alternative I, is expected to result in a somewhat greater overall impact on these populations. Thus, losses occurring as a result of this alternative are expected to require a recovery interval to initial population status somewhat, but not significantly, greater than Alternative I (more than one generation or 2-4 years).

(2) Pacific Region

(a) Threatened or Endangered Species

1) Bald Eagle (Pacific Population)

The routine activities and accidental events assumed to occur in the Pacific OCS Region under Alternative VII do not change from that described for Alternative I. As with Alternative I, given the extremely rare occurrence of bald eagles along the southern California coast, impacts to this species from routine activities associated with Alternative VII are not expected to occur.

A generic discussion of the possible impacts of accidental oil spills on bald eagles is presented in Section IV.D.1.a(5). Based on the impacts of the *Exxon Valdez* oil spill on the Prince Williams Sound population of bald eagles in Alaska (see Section IV.D.1.a), an oil spill along the coast of southern California related to Alternative VII could result in eagle mortality. However, due to the extreme rarity of this species along the southern California coast, the accidental pipeline or Alaskan tanker oil spill assumed to occur as a result of Alternative VII is not expected to impact this species.

A 30,000 bbl Alaskan tanker spill is also assumed to occur within the Pacific OCS Region, off Washington state. A small population (roughly 60-70 pairs) of eagles occurs year-round along the coast of Washington, and a portion of this population could potentially be at risk from a tanker spill. If a tanker spill were to contact the Washington shore or if marine birds and/or mammals were oiled and washed ashore, some eagles could be oiled and mortality could occur. Given the analytical assumptions identified for the Alternative VII, tens of eagles are expected to be lost as a consequence of a spill contacting the Washington coast. Because of the relatively slow population growth rates of bald eagles, recovery in this area could take up to 4 years.

CONCLUSION: Routine activities and accidental oil spills assumed to occur as a result of Alternative VII in the Southern California Planning Area are not expected to have an impact on threatened or endangered populations of bald eagles. An Alaskan tanker spill of 30,000 bbl off the coast of Washington is expected to result in injury and mortality of bald eagles. Assuming a spill contacted the Washington shoreline, tens of eagles are expected to be lost, with recovery taking up to 4 years. There is a up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

2) California Least Tern

Disturbances to least terns may arise from those activities assumed for the Pacific OCS Region under Alternative VII that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on least terns (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from Alternative VII within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Since no new onshore facilities are planned for the Pacific OCS Region under Alternative VII and tern colonies are few in number and widely distributed, impacts from air traffic are expected to be negligible.

As with most birds, California least terns are vulnerable to the effects of oil contact. As outlined in Alternative I analysis (Section IV.D.1.a(5)), if an oil spill occurred from May to September and was in the vicinity of a tern colony, as many as 50 pairs or about 5 percent of the population could be affected. Recovery is expected to take 2-4 years, depending on how severely a colony is affected.

CONCLUSION: Routine OCS-related activities assumed for Alternative VII are not expected to have an impact on California least terns. The principle impacting agent under Alternative VII is oil from an assumed and/or an Alaskan tanker spill. Expected outcome of spill contact with a tern colony are loss of up to 50 pairs (5% of the population) and disruption of the colony's reproductive cycle for that year. Recovery is expected to take 2-4 years. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

3) California Brown Pelican

Disturbances to California brown pelicans may arise from several activities assumed to occur in the Pacific OCS Region under Alternative VII, including vessel and air traffic, platform and pipeline construction, and platform removal. Other activities associated with offshore oil and gas activities are either not expected to have an effect on California brown pelicans (geophysical surveys and platform discharges) or are not projected to occur from Alternative VII within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

The effect of routine OCS-related oil and gas activities on brown pelicans is expected to be limited to the temporary displacement (i.e., a few days) of a few individuals resting or foraging near platform/pipeline construction sites.

A generic discussion of the possible impacts of accidental oil spills on California brown pelicans is presented in Section IV.D.1.a(5). Because this species forages at sea and sometimes rests on the water, brown pelicans could potentially be vulnerable to the effects of spilled oil. In addition, brown pelicans are often concentrated in nearshore waters, conceivably exposing numerous individuals to a given oil spill. Based on the oil spills of 1,000 bbl or more assumed to occur in the Southern California Planning Area under Alternative VII, from 50 to as many as 1,000 adult pelicans could be oiled, with mortality ranging from 20-50 percent of birds contacted. If a spill occurred during the breeding season and contacted a pelican nesting area, major disruptions in reproduction could be expected, with the potential loss of up to 25 percent of active nests. Recovery could be expected within 1 to 4 years.

CONCLUSION: The effect of routine OCS-related oil and gas activities assumed to occur as a result of Alternative VII in the Southern California Planning Area is expected to be limited to the temporary displacement (e.g., a few days) of a few individuals resting or foraging near platform/pipeline construction sites. The principle impacting agent in the Southern California Planning Area is oil from an assumed pipeline spill and/or a tanker spill. From 50 to 1,000 pelicans are expected to be oiled, with mortality occurring in 20 to 50 percent of those contacted; recovery is expected in 2 to 4 years. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

4) Light-Footed Clapper Rail

Disturbances to light-footed clapper rails may arise from those activities assumed for the Pacific OCS Region under Alternative VII that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on light-footed clapper rails (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from this alternative within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Since no new onshore facilities are planned for the Pacific OCS Region under Alternative VII and marshes occupied by this species are few in number and widely distributed, impacts from air traffic are expected to be negligible.

As with most birds, light-footed clapper rails are vulnerable to the effects of oil contact. Since light-footed clapper rails seasonally breed in about 14 widely-spaced marshes from Santa Barbara to the Mexican border (USDOI, FWS, 1980b), an oil spill would have to occur and contact the birds at one of these sites. This is considered unlikely, however, as protective equipment (e.g., oil booms) is readily available throughout the rail's range, and oil can generally be prevented from entering estuaries and marshes. Nevertheless, if an oil spill should occur and contact a rail marsh, some mortality is expected. Depending on various factors (spill date, spill size, weather, distance from shore), the impact on light-footed clapper rails could range from a few individuals to the loss of this species from an entire marsh. Due to the continued depressed population of this species, the loss of more than a few individuals could be significant, requiring from 2 to as much as 6 or 7 years to recover.

CONCLUSION: Routine activities and accidental oil spills assumed to occur as a result of Alternative VII are not expected to have an impact on light-footed clapper rails.

(b) Nonendangered Species

1) Seabirds

General and specific impacts expected to be experienced by seabirds from activities occurring in the Cook Inlet/Shelikof Strait area originally proposed are included in the proposal analysis (Section IV.D.1.a). The enlargement of this proposed sale area results in the addition of two exploration wells. More importantly, the enlargement lies adjacent to important seabird breeding, wintering, and migration areas including Kodiak Island, the Alaska Peninsula, Lower Cook Inlet, and the Kenai Peninsula. Because development potentially could occur at any point in the proposed area, this alternative places at potential risk tens to hundreds of thousands of wintering or migrating seabirds in winter and spring. During the breeding season, foraging seabirds from some 175 colonies (containing well over 1 million individuals) adjacent to the proposed sale area are at risk; approximately 100 additional colonies could be at risk along the eastern shore of the Kodiak archipelago. The Barren Islands colonies, containing an estimated 600,000 individuals before its devastation by the *Exxon Valdez* oil spill, is the largest near the proposed sale area; Semidi Islands National Wildlife Refuge, with 2.5 million birds, lies about 90 miles south of the southern sale-area boundary.

Enlargement of the proposed sale area is expected to place a greater proportion of these populations at risk. Also of concern is the increased potential to disrupt foraging activity which, in turn, may adversely affect migration and reproduction. These potential adverse effects are expected to elevate the overall impact of Alternative VII somewhat above that indicated for Alternative I (e.g., losses during the nesting period requiring several generations, 2-4 years each, for recovery to initial population status; one generation or less if losses occur outside the nesting period).

CONCLUSION: Enlargement of the proposed Cook Inlet/Shelikof Strait sale area under Alternative VII, with its potential exposure of a correspondingly greater proportion of breeding, wintering, or migrating seabirds than Alternative I, is expected to result in somewhat greater overall impact on these populations. Thus, losses occurring as a result of this alternative are expected to require a recovery interval to initial population status somewhat, but not significantly, greater than Alternative I (more than one generation or 2-4 years if occurring outside the breeding period; several generations if during the breeding period).

2) Shorebirds

Disturbances to shorebirds may arise from those activities that can occur in close proximity to the shoreline, mainly air traffic, pipeline construction, and onshore support-facility construction and operations. Other activities (geophysical surveys, platform construction, platform discharges, and platform removal) are not expected to have an effect on shorebirds. The level of these other activities under this alternative is not expected to differ significantly from those discussed for Alternative I in either the Pacific or Alaska OCS Regions.

As in Alternative I, routine activities in the Pacific OCS Region are expected to result in only temporary (i.e., a few weeks) disruptions in the foraging or resting behavior of shorebirds within the immediate vicinity (i.e., within 0.5 km) of helicopter flight paths. Air traffic in the Alaska OCS Region is expected to cause disruptions in reproduction of local (i.e., within 0.5 km of flight paths) shorebird populations, with recovery expected within 1 year. Within the Alaska OCS Region, the construction of pipeline landfalls and onshore facilities is expected to be at the same level of activity as Alternative I. Pipeline landfalls are expected to cause the displacement of shorebirds from the area immediately adjacent to the construction (within a few hundred meters) for about 6-8 weeks. Construction of onshore facilities could result in displacement of shorebirds within about 0.5 km of construction and the loss of about 10-15 hectares of habitat from each planning area. A temporary (i.e., less than 1 year) reduction in local productivity may result if nesting habitat were lost to construction. Because of the widespread distribution of most shorebird species in Alaska and the very small amount of habitat potentially affected, however, construction activities are not expected to cause a long-term (i.e. 1 year), measurable impact to shorebird populations. Existing legislative constraints and permitting procedures would serve to further minimize these localized effects.

The oil spill assumptions for the Pacific Region, including Alaskan tanker oil spills, do not change from Alternative I under this alternative, and the impact of assumed oil spills on shorebirds in the Pacific OCS Region are expected to be the same as for Alternative I (loss of a few to about 500 birds from southern California and Washington, with recovery within 1 year).

The impact of most oil spills assumed for the Alaska OCS Region under Alternative VII, is expected to be similar to those for the Pacific Region as discussed for Alternative I. However, a few areas along the Alaskan coast stand out as being of particular importance to shorebirds, including the North Slope along the shores of the Arctic Ocean (an important shorebird breeding and staging area), the Yukon-Kuskokwim River Delta, and the Seward Peninsula-Copper River Delta region. Because of the higher shorebird densities found in these areas, the effect of a spill contacting one of them could be greater than with spills in other areas.

If a pipeline or platform spill were to contact the North Slope shoreline from May through September, from a few hundred to a few thousand shorebirds could be affected.

If a tanker spill occurred in the Norton Basin Planning Area were to contact the northern Delta, a few thousand shorebirds could be affected, with recovery occurring in 1-3 years.

The Seward Peninsula-Copper River Delta region would most likely be affected by a tanker spill assumed to occur in the Gulf of Alaska Planning Area from proposed development in the Chukchi Sea Planning Area and by a tanker spill assumed to occur from proposed development in the Gulf of Alaska Planning Area. If a tanker spill were to contact the Seward Peninsula coastline or the Copper River Delta from May through September, a few hundred to a few thousand shorebirds could be affected, with recovery occurring in 1-2 years.

Oil spills assumed for other Alaska OCS Region planning areas are either not expected to contact shore (30,000 bbl tanker spill in the Navarin Basin Planning Area) or are expected to affect no more than a few hundred shorebirds with recovery occurring in less than 1 year .

CONCLUSION: Under Alternative VII, impacts on shorebirds from routine OCS-related activities assumed for the Pacific OCS Region are expected to be limited to temporary (i.e., a few weeks) disruptions in the foraging or resting behavior of those shorebirds in the immediate vicinity (i.e., within 0.5 km) of helicopter flight paths. Impacts from air traffic in the Alaska OCS Region are expected to include disturbance of local (i.e., within 0.5 km of flight paths) shorebird populations with some local reductions in productivity, and recovery occurring within 1 year. Construction activities assumed for the Alaska OCS Region are not expected to cause a measurable impact to shorebird populations, although a temporary (i.e.,<1 year) reduction in productivity within 0.5 km of construction is expected.

The principle impacting agent from Alternative VII in both the Pacific and Alaska OCS Regions is oil from accidental spills. Assuming oil contact with the shoreline, injury and mortality of shorebirds are expected to occur, involving a few to as many as 500 individuals, with recovery occurring in 1 to 2 years. Within the Alaska OCS Region the impact of assumed oil spills on shorebirds is expected to range from less than 100 to a few thousand fatalities, with recovery in 1-3 years. There is a 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the alternative in the Alaska Region. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

f. Impacts on Fish Resources

(1) Alaska Region

(a) Pacific Salmon (Alaska Population)

Routine activities and accidental events are assumed to occur at the same levels for Alternative VII as for Alternative I in the Alaska Region with the exception of drilling two additional exploration wells somewhere in the Cook Inlet Planning Area. The analysis for the proposed action considers potential effects within the entire range of this species. Impacts on Pacific salmon under this alternative are expected to be the same as for Alternative I. Section IV.D.1.a(6) described the potential impacts on salmon populations.

CONCLUSION: Routine activities included in the scenario for Alternative VII are expected to have no measurable effect on Pacific salmon. Assumed oil spills contacting migratory salmon populations are expected to have adverse impacts on small segments of these fish populations. The numbers so affected would be small in proportion to the total population, and any oil spill would have only a small-scale, small-area, and short-time effect. There is an 18- to 34-percent chance of one or more spills of 10,000 bbl or greater occurring throughout the pelagic range of migratory salmon over the 24- to 32-year life of the alternative.

(b) Walleye Pollock

Walleye pollock spawn annually in much of Shelikof Strait during spring and early summer. This spawning area lies largely within the enlarged alternative; the area considered for lease under this alternative. However, as analyzed under the proposal, the IPA's are: (1) oil spills, (2) drilling discharges, and (3) offshore construction. As concluded by the proposal analysis, potential adverse impacts would have no appreciable effect on walleye pollock due to the wide distribution of this species, their large populations, and extended annual spawning period.

CONCLUSION: The level of oil and gas exploration/development hypothesized in the scenario for Alternative VII is not expected to have a measurable effect on the walleye pollock population.

(c) Arctic Cisco

General and specific impacts expected to be experienced by the Arctic cisco from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(6). Because arctic cisco are not present in the area that would be added under this alternative, the analysis and resulting conclusion will remain the same as described for Alternative I.

CONCLUSION: Based on the scenario for Alternative VII, it is not expected there would be any appreciable adverse effect on arctic cisco that migrate at some depth in the nearshore waters of the Beaufort Sea.

(d) Other Fish Resources

FINFISH: Pacific halibut, other flounders, Pacific herring, smelt, and cod are located in the enlarged area considered for lease under Alternative VII. These species perform seasonal migrations to different depths and, for the most part, inhabit extensive areas within the Cook Inlet Planning Area. This wide distribution allows for only small numbers to be vulnerable to the IPA's associated with this alternative. The intermittent nature of oil spills and discharges and limited period of drilling discharges further limit vulnerability of fish to these IPA's. Offshore construction disruptions are also very short term.

CONCLUSION: Alternative VII is expected to have no measurable adverse effect on other fish resources of the Cook Inlet Planning Area, and the overall conclusion remains the same as that for Alternative I.

SHELLFISH: The area encompassed by this enlarged area alternative is inhabited by red king crab, Tanner crab, reduced populations of pandalidid shrimp, and numerous other species of crustaceans and mollusks that are all loosely grouped under this general heading. Those species of commercial value (brachyouran crabs and shrimp) inhabit both nearshore and offshore waters, and their early larval forms occur in pelagic waters. As such, these populations are then widely distributed over the more than 6,000 mi^2 (more than 15,000 km^2) of shellfish habitat. The assumed oil spills, drilling discharges, and offshore construction are expected to affect much smaller areas. Adoption of this alternative is expected to cause the same, no-appreciable effects to shellfish in the Alaska Region as those described for Alternative I.

CONCLUSION: Based on the scenario for Alternative VII, no appreciable adverse effect on the shellfish populations in the Alaska Region are expected.

(2) Pacific Region

(a) Pacific Salmon (Pacific Population)

If Alternative VII were selected, the routine activities and accidental events assumed for the proposed action in the Alaska and Pacific Regions would occur. All impacts on commercial fishery resources from both normal development and accidental causes will be the same in the Pacific Region as for Alternative I. Impacts to Pacific salmon populations within southern California from normal OCS activities associated with the proposed action would be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. The assumed oil spills are expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon. A tanker oil spill entering a spawning stream in Washington could cause mortalities to hundreds of salmons in the stream affecting the impacted year class for two to four years. However, regional impacts would not be discernible from natural variations of populations within the area.

CONCLUSION: Adoption of Alternative VII is expected to result in some lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon. A tanker oil spill entering a spawning stream in Washington could cause mortalities to hundreds of salmon in the stream affecting the impacted year class for two to four years. However, regional impacts are not expected to be discernible from natural variations of populations within the area. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Steelhead Trout

Impacts to steelhead trout populations within southern California from normal activities will involve changes in the distribution of some migrating populations for a period of minutes to hours with no discernable change of population levels. Oil spills from a pipeline or tankers are expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore steelhead trout. A tanker oil spill contacting the entrance of a steelhead spawning stream in Washington or southern California (San Luis Obispo County), could result in a 10- to 20-percent reduction of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regional impacts would be less, since not every stream would be affected. Overall, mortality in the affected streams would not be discernible from natural variations of steelhead trout populations within the planning area.

CONCLUSION: Adoption of Alternative VII is expected to result in some lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore steelhead trout. The tanker oil spill contacting the entrance of a steelhead spawning stream in Washington or southern California (San Luis Obispo County), would result in a reduction of 10-20 percent of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regional impacts would be less, since not every stream would be affected and the relative number of the affected population would be lessened, and would not be discernible from natural variations of steelhead trout populations within the area.

(c) Pacific Whiting

Impacts to Pacific whiting populations within southern California from normal activities associated with Alternative VII are expected to be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. Oil spills assumed for the alternative are expected to result in lethal or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

CONCLUSION: Adoption of Alternative VII is expected to result in some lethal (less than 10%) or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

(d) Other Fish Resources

All impacts on other fish resources from both normal development and accidental causes assumed for Alternative VII are expected to be the same in the Pacific Region as for Alternative I discussed in Section IV.D.1.a(6). Routine activities associated with the alternative (installation and operation of manmade structures, effluents and discharges from drilling operations, underwater noise from geophysical surveys) could result in reductions of some local fish populations, but with no lasting effects on trophically dependent species. Recovery of affected local populations would occur within 2 years. Assumed oil spills are expected to result in lethal or sublethal effects locally in the area of contact. Recovery of affected local populations would occur within 2 years. A tanker oil spill entering a spawning stream in Washington could cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for two to four years. Regionally, lethal or sublethal effects would not be discernible from natural variations of fish populations within the area.

CONCLUSION: Adoption of Alternative VII is expected to result in reductions of some local fish populations, but with no lasting effects on trophically dependent species from routine activities. Recovery of affected local populations would occur within 2 years. Oil spills would result in lethal or sublethal effects locally in the area of contact. Recovery of affected local populations would occur within 2 years. A tanker oil spill assumed to enter a spawning stream in Washington is expected to cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for two to four years. Regionally, lethal or sublethal effects would not be discernible from natural variations of fish populations within the area.

g. Reptiles

PACIFIC REGION: Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to sea turtles would remain the same. Section IV.D.1.a(7) provides a discussion of potential impacts on sea turtles and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea turtles include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact sea turtle populations. The low sea turtle densities in the areas assumed to be affected (particularly north of Point Conception) make it unlikely that these animals would be affected by accidental oil spills; if mortality does occur, it is not expected to be distinguishable from natural variability within the species' populations.

CONCLUSION: Adoption of Alternative VII is expected to have no discernible effect on sea turtle abundance or distribution.

h. Impacts on Coastal Habitats

(1) Alaska Region

WETLANDS AND ESTUARIES: The increase in oil and gas exploration activities in the proposed Cook Inlet Planning Area from six exploration wells under the proposed action to eight under Alternative VII, and the increase in the area considered for lease shown on Figure II.G.1-1 is not likely to increase the potential oil-spill effects on coastal wetlands and estuaries in the Cook Inlet or Shelikof Strait area. An oil spill from any lease tract in the proposed lease area would have a high (80%) chance of contacting and affecting coastal wetlands and estuaries in the Cook Inlet-Shelikof Strait area (USDOI, BLM, 1980a, App. D, Table 3, and Figure IV.A.1.d.-1) no matter what the location of the spill site is. Thus, potential oil-spill effects on coastal wetlands and estuaries are expected to be the same as those described under Alternative I. Other development activities such as pipeline landfall development and tanker transportation scenarios, are assumed to be the same as in the proposed action; thus, other types of effects on coastal habitats are expected to be the same as for Alternative I.

CONCLUSION: Under Alternative VII, the primary effects on wetland-estuarine habitats in the Alaska Region are expected to come from a causeway, pipeline-landfall construction, and oil spills. Hydrological effects from the causeway (changes in the physical integrity of perhaps 5 percent of the habitat) and some effects (perhaps 5-10%) on the distribution of species (anadromous fish) are expected to last for more than 10 years. Turbidity effects from pipeline burial on wetland-estuarine habitats are expected to be short term, lasting less than 2 years. Oil-spill contamination of (perhaps several hundred to a thousand kms) wetland-estuarine habitats is expected to have local adverse effects on the biological diversity and productivity of invertebrate communities lasting for more than 10 years.

(2) Pacific Region

WETLANDS AND ESTUARIES: If Alternative VII were selected no impacts from normal activities are expected. Impacts of an oil spill assumed to enter an estuary and remaining for several tidal cycles, are expected to include destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require at least 5 years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no real interference with ecological relationships in the region. No impacts to estuaries were expected in northern California, because an Alaskan tanker spill is assumed to occur approximately 50 miles from shore and is not expected to contact nearshore areas.

CONCLUSION: Under Alternative VII, impacts of an assumed oil spill entering an estuary and remaining for several tidal cycles are expected to include destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require 5 or more years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no real regional interference with ecological relationships. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative.

i. Impacts on Seafloor Habitats

(1) Alaska Region

STEFANSSON SOUND BOULDER PATCH: General and specific impacts expected to be experienced by the Boulder Patch from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(9). Because activities associated with Alternative VII are the same as those hypothesized for Alternative I, the impacts expected on the Boulder Patch under this alternative are the same as those expected for the proposed action.

CONCLUSION: For the Alternative VII, oil-spill effects on the productivity and diversity (perhaps 10%) of the Boulder Patch benthic organisms are expected to persist for 2 years. Turbidity and sedimentation effects on the growth and productivity of benthic organisms (perhaps 1-2%) of the Boulder Patch from pipeline burial and causeway construction are expected to persist for about 2 years.

(2) Pacific Region

(a) Intertidal Benthos

Under Alternative VII impacts from normal activities are not expected. A pipeline oil spill and two of the three hypothesized tanker oil spills (one in Washington and one in southern California) are expected to result in smothering and immobilization to portions of local sandy beach populations of several species in the area contacted by the spill. Recovery of these populations is expected to occur within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community contacted by the spill. Recovery could be retarded in some species for a year. Some assemblages within the community could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis. The spill in northern California is assumed to occur more than 50 miles offshore and is not expected to come ashore.

CONCLUSION: If Alternative VII is adopted, impacts from oil spills are expected to include smothering and immobilization to portions of local sandy beach populations of several species in the area contacted by the spill. Recovery is expected to occur within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community contacted by the spill. Recovery of some local populations could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis. There is a 14 percent probability of one or more spills of 10,000 bbl or more occurring as a result of production in southern California over the 35-year life of the alternative. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Subtidal Benthos

Under Alternative VII impacts from exploration and development activities on the subtidal benthos from routine operations are not expected to measurably impact subtidal organisms in the Pacific OCS Region. However, local impacts could be particularly manifest if platforms or pipelines occurred on or within 100 m (330 ft) of hard bottom features.

An oil spill is expected to result in the loss or functional disruption of a few assemblages or communities at local areas within the region. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of thousands of individuals on the hard bottom community contacted causing alterations of ecological relationships. Recovery is expected to require at least two years.

CONCLUSION: Adoption of Alternative VII is expected to result in the loss or functional disruption of a few assemblages or communities at local areas within the Pacific Region. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of the hard bottom community contacted causing alterations of ecological relationships lasting for at least two years. Functionally, oil contact with a few hard bottom communities would not cause interference with regional ecological relationships or population levels. There is a 14 percent probability of one or more spills of 10,000 bbl or more occurring as a result of production in southern California over the 35-year life of the alternative. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

j. Impacts on Coastal Communities

(1) Alaska Region

(a) Demography and Employment

The scenario assumptions in the Alaska Region for Alternative VII add two exploration wells. All other related activities remain the same as Alternative I.

An oil spill could occur in the Cook Inlet Planning Area. As for Alternative I, it is assumed that most employment associated with oil-spill cleanup would be in locations separated from regional centers, but the actual hiring and population increase would occur in the regional centers.

For Cook Inlet, the cumulative impacts are expected to be such that local employment generated by OCS activity in the peak years of OCS employment accounts for more than 1 percent but less than 5 percent of the projected level of employment for the affected area for less than 2 years, and no sector of the local labor force changes more than 10 percent.

Population increases are expected to be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole would be between 1 and 5 percent for less than 2 years with no change in any sector of the State labor force greater than 10 percent. The principal cause of this impact is that employment and population directly in OCS related activity generate secondary employment on a routine basis.

Impacts of demography and employment that are expected from oil spills are as follows. For each of the six OCS planning areas, an oil spill would generate up to 15 jobs in the closest regional center for up to 1 month. The size of the population increase is expected to be the same as the employment increase, because it is assumed no families would accompany these workers for such a short period of time.

CONCLUSION: The impacts of Alternative VII on demography and employment, are the same as Alternative I. For Cook Inlet, local employment generated accounts for 1 to 5 percent for less than 2 years, and no sector of the local labor force changes more than 10 percent. Population increases are expected to be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole is expected to be between 1 and 5 percent for less than 2 years with no change in any sector of the State labor force greater than 10 percent. An oil spill would generate up to 15 jobs in the closest regional center for up to 1 month.

(b) Land Use

The expansion of the Cook Inlet sale area will alter only slightly the amount of personnel and infrastructure required to produce the sales' hydrocarbon potential. Although this alternative requires the expansion of the sale area in which leases could be chosen, it would not cause an increase in resource estimates. Over the proposal, the primary difference in impact levels between the two alternatives would result from an additional two exploration wells. These additional wells would not cause an increase in required onshore support facilities. Hence, there is only a minor difference between Alternative I and Alternative VII.

CONCLUSION: The impacts of this alternative will not significantly differ from those of Alternative I. Alternative VII could directly and indirectly alter regional land use patterns for over 20 years in those places impacted by pipeline, pipeline-service-road, and processing-facility construction.

(c) Transportation Networks

Relative to the proposed action, this alternative would increase only slightly the flow of material and people on transportation systems serving the Cook Inlet area and would not change the number or type of emplaced petroleum- related facilities from those expected for Alternative I. In the Cook Inlet area, much of the basic production infrastructure such as support bases, airstrips, pipelines, pump stations, and service roads already exist. Additional facilities, would be emplaced as needed, and the level of use and size of these facilities that would serve the Cook Inlet fields would not appreciably be reduced from those of Alternative I. Passenger and material volumes on road, air, and marine systems serving OCS-related petroleum development in the Cook Inlet would rise only slightly due to the increase in exploration activity. Resource estimates for this alternative are all the same as those for Alternative I. Accordingly, there should be no change in impacts on transportation systems in the Cook Inlet for this alternative from those of Alternative I.

CONCLUSION: Based on the scenario for Alternative VII, vessel and air traffic in Alaska are not expected to increase to the point where the transportation systems are stressed.

(d) Sociocultural Systems

The characteristics of the environment upon which to assess effects on sociocultural systems in Alternative VII are the same as for Alternative I. The IPA's that could affect sociocultural systems also are the same as for Alternative I, including the introduction of changes in industrial activities, changes in local population and employment, and effects on subsistence harvests and networks.

The number of assumed pipelines, pipeline landfalls, shore bases, and miles of pipelines in this alternative are the same as for Alternative I. Effects on sociocultural systems from constructing these facilities and the associated increased employment and population involved should be the same as for Alternative I.

Effects on sociocultural systems in Alaska and the contiguous U.S. from effects on subsistence harvests and networks from oil spills would be the same as Alternative I in that the only change from Alternative I, aside from the area expansion, is the addition of two more exploratory wells. Potential spills from pipelines, platforms, and tankers remain the same as Alternative I.

The enlarged area of the alternative may change the communities that would experience stressed sociocultural systems from impacts to subsistence, but the overall level of effects remains the same as for Alternative I.

The effects of added measures of protection would be the same as for Alternative I.

CONCLUSION: Based on the scenario assumptions, Alternative VII is expected to contribute to the increasing urbanization of the North Slope Borough, and Barrow in particular, and increase the need for wage income. Dysfunctional social effects, such as domestic violence and substance abuse, are expected to be sustained and perhaps increased. Adverse effects on subsistence, especially from oil spills, is expected to adversely affect sociocultural systems. Effects on sociocultural systems are expected to be most unsettling in areas that are least urbanized.

(2) Pacific Region

(a) Demography and Employment

Under Alternative VII, impacts to employment and population in Alternative VII are expected to be identical to those identified for Alternative I.

It is assumed that if one or more oil spills occurred and contacted the coast, it would involve some employment opportunities in cleanup operations. Employment from oil spill cleanup activities due to this alternative is approximately equivalent to 400 person-years of employment. But it is expected that employment would be temporary and would not involve any population increase.

CONCLUSION: The expected impacts to employment and population under Alternative VII are the same as under Alternative I (less than one percent of the general growth).

(b) Land Use

Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to land use in Alternative VII are identical to those identified for Alternative I.

Under Alternative VII, no changes to land use are expected since no new onshore facilities are assumed to be constructed. But housing needs for the new resident population could result in the conversion of about 230 acres of open space land for residential use.

CONCLUSION: If Alternative VII is adopted, no changes to land use are expected. However, as in Alternative I, the housing needs of the estimated 2,300 new residents could result in the conversion of about 230 acres of open space land for residential use. Impacts to land use as a result are expected to be less than one percent.

(c) Vessel Traffic and Ports

As a result of the Alternative VII, there could be an increase in the number of crew and supply boats operating in southern California. It is assumed that during the exploration and development phase there will be two supply boat trips per week and two crew boat trips per day for each platform or rig. During the production phase, this will be reduced to one supply boat trip per week and two crew boat trips per day per platform. When these vessels use or traverse traffic lanes which cross the proposed leasing area, potential conflicts could occur. These conflicts include collisions and vessel rerouting. Conflicts could also arise when vessels do not adhere to designated traffic lanes. At this time, no temporary or permanent structures exist in the traffic lanes, precautionary areas or safety fairways.

Temporary impacts of up to two months to marine vessels, such as rerouting and/or preclusion from leaving port are expected as a result of the hypothesized oil spills, which included a pipeline spill in southern California, tanker spills off the coast of Washington, northern California, and southern California. This risk off northern California would be reduced slightly since it was assumed to occur approximately 50 miles offshore and is not expected to reach shore.

CONCLUSION: Impacts due to Alternative VII are expected to remain the same as Alternative I. Due to an assumed oil spill, some impacts are expected to large marine vessels and local commercial fishing vessels. Ship traffic may be rerouted around the spill for the duration of the at-sea-cleanup activities (which could last from 30 to 60 days). There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(d) Public Services

As a consequence of Alternative VII, all activities and accidental events that are part of the proposed action would still occur. Therefore, impacts to the water supply are identical to those identified for Alternative I.

The activities associated with the Alternative VII scenario are expected to result in an increase in water demand of about 10 million gallons of potable water in the peak year 2007 and about 47 million gallons of non-potable water.

CONCLUSION: The Alternative VII is expected to result in an increase in water demand of about 10 million gallons of potable water in the peak year 2007 and about 47 million gallons of non-potable water. This increase in demand would put more pressure on already limited existing water supplies in the southern California area.

k. Impacts on Fisheries

(1) Alaska Region

COMMERCIAL FISHING: The routine activities associated with Alternative VII that may affect commercial fishing are: OCS-vessel traffic that could conflict with commercial-fishing traffic, especially in areas such as enclosed bays; wells, platforms, and offshore pipelines; and onshore marine bases that are also used by the commercial- fishing industry. Two exploration wells are assumed for Alternative VII while the other related OCS activities remains the same as Alternative I.

Potential adverse effects on the commercial-fishing industry include: (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; (3) loss or damage to fishing vessels through collisions with oil-industry vessels; (4) competition for support services, infrastructure, materials, and labor; and (5) competition for space onshore.

Oil spills could damage the commercial fisheries by gear fouling; preemption or closure of fishing areas; direct loss of catch; and contamination or tainting of harvest. The number of spills would be the same for Alternative VII as Alternative I. Impacts on water quality from oil spills, which are analyzed in the water-quality Section, are used in analyzing impacts on commercial fish. The conclusion of that section is that water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for about 30 days.

None of the stipulations that potentially would be adopted for the five sale areas with commercial fishing would change any impacts, if adopted.

For the Cook Inlet Planning Area, the expected impact of Alternative VII on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear up to 5 percent and loss of secondary employment up to 5 percent resulting from (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; and/or (3) loss or damage to fishing vessels through collisions with oil-industry vessels. This will be the same in all planning areas with commercial fisheries. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor as a result of increased competition. Costs to commercial fishermen are expected to increase no more than 10 percent for space onshore as a result of increased competition. These impacts are expected to last for as many seasons as there is OCS activity.

CONCLUSION: The impacts for Alternative VII are the same as for Alternative I. For each of the planning areas with commercial fishing, it is expected the impact on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear up to 5 percent and loss of secondary employment up to 5 percent. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor and no more than 10 percent for space onshore. These impacts are expected to last for as many seasons as there is OCS activity.

As a result of an oil spill, commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days, the commercial fisheries are expected to have up to 5 percent loss of catch and up to 5 percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil could be up to 5 percent. There is an up-to-81-percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the western coast of the U.S. over the 24- to 32-year life of the alternative.

(2) Pacific Region

(a) Commercial Fishing

Under Alternative VII, impacts to commercial fisheries from routine activities (installation and operation offshore manmade structures, vessel traffic, effluents and discharges) and small oil spills are expected to involve inconveniences lasting for the 35-year life of the platform with little or no discernible economic loss. Oil spills from a pipeline or tankers contacting fixed gear fishing sites could result in economic losses ranging from 20 to 30 percent lasting for two seasons, with more than 10 percent unemployment among fixed-gear fishermen. Financial losses to economically dependent businesses in nearby communities could range up to 20 percent.

CONCLUSION: Adoption of Alternative VII is expected to result in economic losses ranging up to 30 percent for affected fixed-gear fishermen. Financial losses to economically dependent businesses in nearby communities could range up to 20 percent. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Recreational Fishing

If Alternative VII were selected, routine activities (installation and operation of manmade offshore structures, increased vessel traffic, and drilling discharges) are expected to result in economically indiscernible minor inconveniences to marine recreational fishing activities. While numerous, small oil spills are assumed to occur, they are unlikely to have any impact on recreational fishing. Assumed oil spills contacting a harbor used by sport fishermen are expected to result in local economic losses of 10 to 20 percent over a period of approximately a month, or the length of time needed for spilled oil to be cleaned up or dissipated by wind and waves. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced by the alternative, fisheries resources available to sportfishermen will be unchanged.

CONCLUSION: Adoption of Alternative VII is expected to result in local economic losses of 10 to 20 percent over a period of approximately a month. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced, fisheries resources available to sportfishermen will be unchanged. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

l. Impacts on Subsistence

(1) Alaska Region

The characteristics of the environment upon which to assess effects on subsistence for Alternative VII are the same as for Alternative I. The impact-producing agents also are the same as for Alternative I, including oil spills, noise and traffic disturbance, or disturbance from construction activities associated with pipelines and shore-base facilities.

The number of pipelines, pipeline landfalls, shore bases, and miles of pipelines in this alternative are assumed to be the same as for Alternative I. Effects on subsistence from constructing these facilities and the associated increased employment and population involved should be the same as for Alternative I.

Effects on subsistence in Alaska and the contiguous U.S. from effects on subsistence harvests and networks from oil spills would be the same as Alternative I in that the only change from Alternative I, aside from the area expansion, is the addition of two more exploratory wells. Potential spills from pipelines, platforms, and tankers remain the same as Alternative I.

The enlarged area of the alternative may change the communities that would experience stressed sociocultural systems from impacts to subsistence, but the overall level of effects remain the same as for Alternative I.

The effects of added measures of protection would be the same as for Alternative I.

CONCLUSION: Impacts on subsistence under Alternative VII are expected to be centered predominantly on the arctic communities of the NSB as a result of the four proposed Chukchi and Beaufort Seas sales. One or more important subsistence resources are expected to become unavailable, undesirable for use, or available only in greatly reduced numbers for one or more periods of 1 to 2 years during the life of the proposed leases in the Arctic. Effects on subsistence in the Gulf of Alaska include reducing the availability or accessibility of at least one important subsistence resource for a period not exceeding 1 year. Similar effects would be expected on Kodiak Island and on the Alaska Peninsula. The subsistence of Bristol Bay and Alaska Peninsula residents would be affected for at least 1 year. There is an 18 to 81 percent probability of one or more spills of 10,000 bbl or greater occurring in the Alaska Region over the 30-year life of the proposal.

(2) Pacific Region

Routine activities associated with Alternative VII in the Pacific Region, including the construction of subsea pipelines and platforms, the drilling of exploratory and production wells, and drill rig and platform removal, are expected to occur at least 3 miles offshore, away from intertidal gathering areas. No impacts to intertidal gathering areas are expected.

Three oil spills of 1,000 bbl or greater are assumed to occur in the Pacific Region and to contact the shoreline under this alternative; one off the coast of Washington, and two off southern California. Impacts to subsistence resources from accidental pipeline spills or spills of Alaskan oil transported by tankers greater would depend upon the location and season. The greatest effects to subsistence could be expected if the spill contacted rocky intertidal areas near population centers. This could have the effect of reducing the availability or desirability of one or more important species in some local areas on the coast for up to a year.

CONCLUSION: Adoption of Alternative VII is expected to result in temporary effects on subsistence in the Pacific Region due to accidental oil spills. No impacts to onshore and intertidal gathering areas from routine exploratory and development activities associated with this alternative are expected. Assuming occurrence and contact, an oil spill that contacts an intertidal subsistence area is expected to result in a reduction in the availability or desirability of one or more subsistence resources for up to a year. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

m. Impacts on Archaeological Resources

(1) Alaska Region

In this alternative, the Cook Inlet area considered for leasing would be enlarged. OCS activity could occur on these added tracts. Also, two exploration wells would be added to those analyzed in Alternative I. These activities could result in impacts to archaeological resources.

Adding two exploration wells to the scenario would not increase the probability of pipeline-construction activity effects and oil-spill cleanup effects on archaeological resources. Therefore, it is expected that the effects on prehistoric or historic sites being disturbed is the same as analyzed in Alternative I.

CONCLUSION: Under Alternative VII, it is expected that some impact may occur to coastal historic and prehistoric archaeological resources from accidental oil spills. Although it is not possible to predict the precise numbers or types of sites that would be affected, it is expected that under this alternative a slightly less amount of significant archaeological information will be lost compared to Alternative I.

(2) Pacific Region

Archaeological resources could be affected as a result of bottom disturbing activities, such as exploratory drilling, installation of platforms, or installation of offshore pipelines. However, prior to the initiation of drilling operations, locating platforms, or pipeline operations, remote sensing surveys are conducted at prospective well and platform sites, and along pipeline corridors. The results of these surveys are used to identify and avoid any anomalies that may represent archaeological resources. Any site that is discovered during operations will be reported, and the operator will be required to follow directions from MMS to protect the resource.

No new onshore facilities or new pipeline landfalls were expected for Alternative VII. Existing facilities may have to be modified to accommodate additional OCS production, but all modifications will occur within the boundaries of current facilities. Consequently, no impacts to archaeological resources are expected from onshore facility construction.

The seven platforms assumed for alternative VII are not expected to cause a change in the surroundings of any site such that its National Register eligibility would be affected. Therefore, no impact to onshore archaeological resources is anticipated in the sale area from the intrusion of platforms into the viewshed of the archaeological resources in the area.

Impacts to archaeological resources from accidental pipeline spills or spills of Alaska oil transported by tankers include temporary degradation of the viewshed of any historic or prehistoric sites, and damage to potential archaeological sites during clean up operations. Degradation of a historic viewshed could negatively affect a site's National Register eligibility. The duration this impact depends on the size of the spill, the oil retention of the particular stretch of coastline, and the amount of clean up effort. It is anticipated that spill cleanup operations will take a few weeks to one month. Once the cleanup is completed, the viewshed is expected to return to its pre-spill state.

Archaeological sites can be accidentally damaged or destroyed during cleanup operations as the crisis atmosphere of the cleanup would likely preclude a survey to identify and protect sites in the area. The level of damage would depend on the value of information lost at each affected site and the number of sites impacted.

Submerged sites are not expected to be impacted by an oil spill unless the oil sinks and settles on the bottom, coating any artifacts that may be present. The impact to any submerged sites contacted by oil will depend upon the amount of contamination, and how the artifact responds to the coating of oil. If artifacts absorb oil it could affect radiocarbon dating of the site. Overall, accidental oil spills are expected to result in a negligible loss of scientific information from archaeological resources.

CONCLUSION: Routine OCS activities associated with the Alternative VII are expected to have negligible impacts on archaeological resources in the Pacific Region. Assuming a spill and contact with the shoreline, the viewshed of onshore prehistoric or historical sites would be temporarily degraded during the spill and associated cleanup activities. The probability of one or more pipeline spills greater than 10,000 bbl occurring off southern California is approximately 14 percent. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

n. Impacts on Recreation and Tourism

PACIFIC REGION: Under Alternative VII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Consequently, impacts to recreation resources in Alternative VII are identical to those identified for Alternative I (Section IV.D.1.a(14)).

Installation of new platforms on existing leases within 16 km (10 miles) of the coast will cause a noticeable change in local scenery. Impacts on tourism are expected to be inconsequential.

Crew and supply vessels associated with existing and projected facilities are not expected to result in measurable impact to recreational boaters because these vessels will operate from existing ports and use established vessel traffic lanes.

Installation of offshore pipelines will temporarily disrupt recreational activities in the vicinity of the pipeline route for the duration of construction operations, approximately 3-4 months. No measurable impacts to the levels of tourism activities are expected in communities near pipeline installation operations.

Impacts to recreational resources from an accidental pipeline spill or spills of Alaska oil transported by tankers greater than 1,000 bbl include closure of the affected beach for approximately one month, temporary displacement of resource users to unaffected sites, financial losses to local merchants servicing the contaminated area, and temporary degradation of aesthetic qualities of the spill site. These impacts are expected to continue for the duration of clean up operations, approximately one month.

CONCLUSION: Under Alternative VII, routine operations on existing leases are not expected to affect recreation resources or tourism levels. A change of scenery quality is expected in areas where one or more platforms is installed within sight of the coast line. An accidental tanker spill of imported oil is expected to close recreation facilities at the affected site for one month. Recreation resource users will be temporarily displaced and local merchants deriving income from those users will experience an economic loss during the clean up period.

8. Alternative VIII — St. George and Hope Basins

Alternative VIII changes the timing and location of sales considered in Alternative I for the Bering Sea and Arctic Subregions. In Alternative VIII, future leasing would be considered in the St. George Basin and Hope Basin Planning Areas instead of a sale in either Norton, Navarin, or St. Matthew-Hall Planning Areas and instead of a sale in either the St. George Basin or Hope Basin Planning Areas (see Table II.H.1-1). Alternative VIII does not change the size, timing, or location of possible leasing activities in the Gulf of Mexico or Atlantic Region. Resource estimates, associated exploration and development, and oil spill assumptions for these two Regions remain the same as stated in Alternative I. Therefore, the impacts expected from activities in the Gulf of Mexico and Atlantic Regions for Alternative VIII are identical to the impacts described for Alternative I (see Section IV.D.1.a).

Leasing activities, resource estimates, and scenario assumptions in the Pacific Region also remain the same for Alternative VIII as for the proposed action. However, the potential impacts to some migratory species that occur in both the Pacific and Alaska Regions may change under this alternative because of changes in activities assumed in the Alaska Region. Therefore, this section includes an analysis for the Alaska and Pacific Regions.

RESOURCE ESTIMATES: Resource estimates for Alternative VIII, are presented in Table IV.D.8-1. Section IV.D.1.a provides a discussion on the PRESTO model used to calculate the resource estimate that are assumed to be leased, discovered, and produced.

Table IV.D.8-1. Conditional Resource Estimates — St. George and Hope Basins

REGION AND PLANNING AREA	OIL (BBO)	GAS (TCF)	MP_{HC}
GULF OF MEXICO REGION			
Western Gulf of Mexico	0.23	3.51	1.00
Central Gulf of Mexico	0.57	5.64	1.00
Eastern Gulf of Mexico	0.02	0.22	1.00
ALASKA REGION			
Beaufort Sea	0.52	—	0.16
Chukchi Sea	2.01	—	0.21
Hope Basin	0.24	—	<0.01
St. George Basin	0.23	—	0.02
Cook Inlet	0.16	—	<0.01
Gulf of Alaska	0.34	—	0.04
PACIFIC REGION			
Southern California	0.33	1.01	1.00
ATLANTIC REGION			
Mid- and South Atlantic	0.08	2.24	0.63

BBO - Billion Barrels of Oil
TCF - Trillion Cubic Feet
MP_{HC} - Marginal Probability of Commercial Hydrocarbons

EXPLORATION AND DEVELOPMENT ASSUMPTIONS: The hypothetical scenarios concerning exploration and development activities for Alternative VIII were developed using the same assumptions as in Alternative I (Section IV.D.1.a). The level of offshore and onshore activities are based on the amount of hydrocarbon resources assumed to be leased, developed, and produced as a result of sales in Alternative VIII (see Tables IV.D.8-2 and IV.D.8-3).

Table IV.D.8-2. Exploration And Development Activity — St. George and Hope Basins

Planning Area	Sales (No.)	BBOE	MP$_{HC}$	Exp./Del. Wells (No.)	Dev./Pro. Wells (No.)	Platforms (No.)	Years Of Activity
Western Gulf of Mexico	5	.85	1.00	1000	540	50	1993-2030
Central Gulf of Mexico	5	1.57	1.00	1380	980	110	1994-2031
Eastern Gulf of Mexico	2	.05	1.00	90	40	8	1998-2036
Beaufort Sea	2	.52	0.16	12	70	3	1994-2021
Chukchi Sea	2	2.01	.21	47	268	7	1995-2025
Hope Basin	1	.24	<0.01	8	34	1	1996-2021
St. George Basin	1	.23	0.02	8	50	1	1996-2021
Cook Inlet	1	.16	<0.01	6	26	1	1995-2019
Gulf of Alaska	1	.34	0.04	11	53	1	1996-2021
Southern California	1	.51	1.00	25	150	7	1998-2030
Mid- and South Atlantic	2	.48	0.63	32	108	6	1995-2024

MP$_{HC}$ - Marginal Probabilty Of Commercial Hydrocarbons
BBOE - Billion Barrels of Oil Equivalent

TRANSPORTATION AND MARKET ASSUMPTIONS: The amount of natural gas and oil resources assumed to be leased and developed in the St. George Basin and Hope Basin Planning Areas are identical to those of the proposal (Alternative I). Thus the basic assumptions used in Alternative I concerning how gas and oil production will be transported to shore (Section IV.D.1.a) are applicable to Alternative VIII. No assumption was made concerning the amounts of natural gas and oil that would be foregone as a result of the adoption of Alternative VIII.

OIL SPILL ASSUMPTIONS

Oil Spills Greater Than or Equal to 1,000 bbl. Table IV.D.8-4 presents the number and type of oil spills assumed to occur as a result of OCS activity associated with Alternative VIII. The source and number of assumed spills were based on the volume of oil listed in Table IV.D.8-1, and assumptions on the mode of transportation and spill rates for spills greater than or equal to 1,000 bbl (see Section IV.D.1.a).

Table IV.D.8-5 presents the probabilities of one or more spills of 1,000 bbl or greater and 10,000 bbl or greater occurring. These probabilities are based on the total estimated mean number of spills assumed to occur as a result of oil production from the adoption of Alternative VIII. It is also assumed that these spills would occur with uniform frequency over the life of the alternative.

Table IV.D.8-6 presents the assumed location of tanker spills along the tanker routes. Tanker spills resulting from production in the Beaufort and Chukchi Sea Planning Areas are assumed to occur outside of those planning areas. Oil produced in the Beaufort and Chukchi Sea Planning Areas would be transported by the TAPS to the Valdez terminal facilities and then transported by tanker to

Table IV.D.8-3. New Offshore and Onshore Infrastructure — St. George and Hope Basins

Planning Area	Platforms (No.)	Oil and Gas Pipelines[3,6,7,8] (No.)	Oil and Gas Pipelines [7,9] (Miles)	Pipeline Landfalls (No.)	Shore Bases/ Support Facilities (No.)
Western Gulf of Mexico	50	–	1020	2	2[1]
Central Gulf of Mexico	110	–	1240	2	2[2]
Eastern Gulf of Mexico	8	–	445	–	–
Beaufort Sea	3	–[4]	275	1	1[5]
Chukchi Sea	7	–[4]	250	1	1[5]
Hope Basin	1	1	90	1	1[5]
St. George Basin	1	–	–	–	1[5]
Cook Inlet	1	1	25	1	1[5]
Gulf of Alaska	1	1	100	1	1[5]
Southern California	7	14	50	–	–
Mid- and South Atlantic (Part D)	6	3	500	3	6[10]

1. Gulf of Mexico Region - additional support facilities: 2 new marine terminals.
2. Gulf of Mexico Region - additional support facilities: 1 new marine terminal and 1 new pipeline yard.
3. Alaska Region - oil pipelines only.
4. Alaska Region - offshore gathering system.
5. Shorebases can include tank farms, docks, air bases, utilities, supply depots and personnel quarters.
6. Pacific Region - total number of oil and gas pipelines.
7. Pacific and Gulf of Mexico Regions - oil and gas pipelines are layed along the same pipeline corridor.
8. Atlantic Region - gas pipelines only.
9. Atlantic Region - total pipeline miles includes gathering and trunk lines.
10. Atlantic Region - additional support facilities: 2 new gas plants, 2 new heliports and 2 supply bases.

west coast ports. Based on the destination and amount of the TAPS oil shipped from Valdez to west coast ports (Puget Sound, Washington; San Francisco and Los Angeles, California), it is reasonable to assume that a tanker spill should occur along the tanker route to these ports.

The probabilities of one or more pipeline or platform spills equal to or greater than 1,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 46 percent and 92 percent, respectively. The probabilities of one or more pipeline or platform spills equal to or greater than 10,000 bbl assumed to occur as a result of activities in the Beaufort and Chukchi Sea Planning Areas are 19 percent and 57 percent, respectively. As a result of the transportation of oil from the Chukchi Sea Planning Area, there is a 93-percent probability of one or more spills of 1,000 bbl occurring and a 81-percent probability of one or more spills of 10,000 bbl or greater occurring. As a result of the transportation of oil from the Beaufort Sea Planning Area, there is a 46-percent probability of one or more spills occurring and a 36-percent probability of one or more spills of 10,000 bbl or greater occurring.

Oil Spills Greater Than 1 bbl and Less Than 1,000 bbl. Table IV.D.8-7 presents the estimated mean number of small spills assumed to occur as a result of the adoption of Alternative VIII. Section IV.D.1.a presents the assumptions used in the calculation of small spills.

Table IV.8.-4. Oil Spill Assumptions — St. George and Hope Basins

	Assumed Oil Spills[2]		
Planning Area	**Platform (Nos.)**	**Pipeline (Nos.)**	**Tanker (Nos.)**
Western Gulf of Mexico	–	1	–
Central Gulf of Mexico	1	1	–
Eastern Gulf of Mexico[1]	–	–	–
Beaufort Sea	–	1	1
Chukchi Sea	1	2	3
Hope Basin	–	–	1
St. George Basin	–	–	1
Cook Inlet	–	–	1
Gulf of Alaska	–	–	1
Southern California	–	1	–
Mid-and South Atlantic[1]	–	–	–

1. No spill was assumed — total estimated mean number of spills was 0.14 - Mid- and South Atlantic; 0.03 - Eastern Gulf of Mexico
2. Based on the total estimated mean number of spills greater than or equal to 1,000 bbl.

Table IV.D.8-5. Oil Spill Probabilities — St. George and Hope Basins

			Probability of 1 or more spills occurring	
Planning Area	**Oil (BBO)**	**MP$_{HC}$**	**1,000 bbl or greater**	**10,000 bbl or greater**
Western Gulf of Mexico	0.23	1.00	28%	10%
Central Gulf of Mexico	0.57	1.00	52%	22%
Eastern Gulf of Mexico	0.02	1.00	3%	< 1%
Beaufort Sea	0.52	0.16	73%	48%
Chukchi Sea	2.01	0.21	**%	96%
Hope Basin	0.24	<0.01	47%	27%
St. George Basin	0.23	0.02	34%	21%
Cook Inlet	0.16	<0.01	34%	18%
Gulf of Alaska	0.34	0.04	59%	34%
Southern California	0.33	1.00	34%	14%
Mid-and South Atlantic	0.08	0.63	13%	7%

**probability of one or more spills occurring is greater than 99.5%

BBO - Billion Barrels of Oil

Table IV.D.8-6. Oil Spill Assumptions — St. George and Hope Basins
Assumed Location of Tanker Spills

Location of the Tanker Spill Planning Area	Assumed Tanker Spills (Nos.)
Hope Basin	1
St. George Basin	1
Cook Inlet	1
Gulf of Alaska	2
Washington and Oregon	1
Northern California	1
Southern California	1

Table IV.D.8-7. Small Spill Assumptions — St. George and Hope Basins

Planning Area	Assumed Small Spills >1≤50 bbl[1]	Assumed Small Spills >50<1,000 bbl[2]
Western Gulf of Mexico	31	1
Central Gulf of Mexico	77	3
Eastern Gulf of Mexico	3	–
Beaufort Sea	132	5
Chukchi Sea	515	21
Hope Basin	61	2
St. George Basin	58	2
Cook Inlet	41	2
Gulf of Alaska	86	3
Southern California	24	1
Mid-and South Atlantic	20	1

Small Spills Rates per billion bbls of oil produced:

1. Gulf of Mexico Region - 135; Alaska and Atlantic Regions - 253.63; Pacific Region - 72.65
2. Gulf of Mexico Region - 5 ; Alaska and Atlantic Regions - 10.25; Pacific Region -2.14

a. Impacts on Water Quality

(1) Alaska Region

Routine activities associated with this alternative that are likely to affect water quality are drilling and production discharges (muds and cuttings, formation waters) and construction activities (dredging, siting, and platform removal). Eight exploration and delineation wells would be drilled in each planning area; while 34 production/development wells would be drilled in the Hope Basin and 50 drilled in the St. George Basin. Exploration discharges are not likely to exceed water-quality criteria outside of a 100-m radius, or 0.03 km^2 around each drill site. The effect of exploration discharges on water quality would persist for a few hours within the 100-m radius mixing zone around each platform. The maximum area temporarily degraded at one time in the Hope Basin would be 0.06 km^2 (1997) and 0.06 km^2 (1997) in the St. George Basin. Discharges of muds and cuttings resulting from this alternative would degrade water quality on less than 1 percent of each planning area. See Section IV.D.1.a(1) for additional information on muds and cuttings.

Production drilling discharges would be on the same order of magnitude as exploration discharges, assuming that maximum discharge rates are limited by USEPA to the same extent during production as in exploration.

Over the life of the fields, the volume of formation waters produced is equal to 20 to 150 percent of the oil-output volume (Collins et al., 1983). In the Hope Basin, the volume of formation waters discharged could range from 48 to 360 MMbbl, while in the St. George Basin the discharge volume could range from 46 to 345 MMbbl. Under this alternative, the discharge of formation waters would degrade water quality on less than 1 percent of each planning area. See Section IV.D.1.a(1) for additional information on formation waters.

Sediment resuspension, and bottom disturbances are likely to occur as a result of siting and removing platforms and trenching and burial of subsea pipelines. The amount of sediment disturbance associated with platform siting, anchor setting, and drilling would be comparatively small with sediment levels likely to be reduced to background levels within several hundred meters downcurrent. Trenching of 90 km of pipeline in the Hope Basin and dumping of dredged spoils would disturb about 5 km^2 in the Basin. Pipelines are not required in the St. George Basin.

Over the actual period of pipeline dredging in the Hope Basin (1 year), perhaps an equal area would be affected by turbidity from dumping on a daily basis. Dumping of dredged spoils is not expected to introduce or mobilize any chemical contaminants.

In addition to permitted discharges, accidental oil spills occur. One oil spill of 1,000 bbl or greater is assumed to occur in each of the planning areas. In addition, 63 small spills of less than 1,000 bbl are assumed to occur in the Hope Basin and 60 small spills are assumed to occur in the St. George Basin.

Sustained degradation of water quality to levels exceeding State and Federal criteria from hydrocarbon contamination is unlikely. Hydrocarbon concentrations from one oil spill in each planning area of greater than 1,000 bbl could exceed the chronic criteria of 0.015 ppm total hydrocarbons on up to several thousand square kilometers for a short period of time (about 30 days). However, this would depend on the on the size, location, and season of the spill. The persistence of individual oil slicks would be short term (less than 1 year). The small spills under 1,000 bbl estimated to occur over the life of the fields would result in local chronic contamination.

CONCLUSION: Trace-metal and oil and grease concentrations in discharges are not likely to exceed water-quality criteria outside a 100-m radius around each drill site or production platform. Discharges would reduce water quality on considerably less than 1 percent of the Hope Basin and St. George Basin Planning Areas. This reduction in water quality would exist only during periods of actual discharge and would rapidly dissipate on completion of the discharge. Water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for a short period of time (about 30 days). The principal cause of impacts is spilled oil, and the probability of one or more spills of 1,000 bbl or greater occurring over the life of the fields ranges from 34 to 47 percent.

(2) Pacific Region

Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Consequently, impacts on water quality in the Pacific Region would remain unchanged from Alternative I. Section IV.D.1.a(1) provides a discussion of potential impacts on water quality in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine operational effluents include 1) formation, or produced water; 2) drilling muds and cuttings; and 3) other routine discharges such as ballast water, cooling water, desalinization brine, excess cement, deck drainage, and treated sewage. Resuspension of bottom sediments will also occur during most routine operations. Effluents and resuspended sediments resulting from routine activities in the Pacific Region are expected to cause some mortality of marine organisms within 300 to 500 m of discharge sites and elevated levels of contaminants and turbidity above ambient levels within 1,000-2,000 m.

Four oil spills of 1,000 bbl or more are assumed to occur in the Pacific Region under this alternative: one off the coast of Washington, one off northern California, and two off southern California. Accidental oil spills are expected to elevate hydrocarbon levels up to 100+ug/l and to limit water use in areas of 1,000-2,000 km^2 over a period of several days to weeks.

CONCLUSION: Adoption of Alternative VIII is expected to result in effects on water quality and water use over areas of a few thousand km^2 for periods of days to weeks. Accidental oil spills are expected to be the major cause of impacts. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is a up to 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

b. Impacts on Air Quality

(1) Alaska Region

Virtually all phases of activities-exploration, development, and production—have emissions with potential to change the concentration of pollutants in the ambient air. Emissions are the result of burning fuel in diesel engines or turbines to generate electricity.

Accidental emissions result from potential gas blowouts, evaporation of spilled oil, and burning of spilled oil. Oil spills of 1,000 bbl or more are assumed for Alaskan Planning Areas from pipelines, platforms, and tankers as described for Alternative I (Please refer to Section IV.D.1.a).

Estimates of emissions that could affect onshore ambient air quality are based on fuel consumption from diesel engine and turbine generation of shipboard and platform electricity. Electricity consumption is based primarily on the number of exploration, delineation, and production wells and their depth and the annual oil-production rate. This information is used to prepare an estimate of annual emissions of criteria pollutants for the peak year of exploration development and production phases for Alternative I. The analysis for Alternative I describe under Section IV.D.1.a(2) is applicable for this alternative.

Eight sales would be held offshore Alaska if Alternative I or VIII is adopted. These sales would occur in the same planning areas for either alternative except that one sale would be held in Hope Basin under Alternative VIII rather than in Navarin Basin as was assumed for the Alternative I base-case analysis. Activity in the Hope Basin planning area for peak-year exploration and delineation wells, production and service wells, and platform and production are 3 (1997-1998), 10 (2001-2002), 1 (2000) and 20 (2004-2008), respectively.

The timing is expected to be the same as for the scenario for Alternative I. Because of the low level of pollutants in the Alaskan onshore ambient air and continual diffusion of OCS emissions that reach the shoreline, changes in air quality due to OCS emissions will occur only during the time activities are being conducted. Air quality will quickly return to the state it would otherwise have been soon after (weeks to months) OCS activities cease. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions), starting in year 10. Production is expected to occur from years 12 to 30 after the lease sale, with the highest level of production occurring during the first year of development.

The NO_x emissions for diesel engines (during exploration) would result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.16 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. Exploration is expected to occur over a 5-year period beginning the year after a lease sale occurs. Development would be expected over a 4-year period (period of greatest annual emissions), starting in year 10.

Potential accidental emissions are discussed in the scenario for Alternative I. Potential accidental emissions for Alternative VIII would be about the same as for the scenario for Alternative I. The VOC from an oil spill and SO_2 and VOC from a gas blowout are pollutants expected from accidents. The SO_2 and VOC from accidents are expected to be less than from normal operations and last a short period after emissions cease.

CONCLUSION: Based on the scenario for alternative VIII, the NO_x emissions for diesel engines (during exploration) would result in NO_x increases to the ambient air of 0.30 to 0.73 ug/m^3 at the shoreline during exploration and 0.01 to 0.16 ug/m^3 at the shoreline during production. Concentrations of other pollutants would be about 3 to 50 percent of NO_x concentrations. The SO_2 and VOC from assumed accidents are expected to be less than from normal operations and last less than a week after emissions cease.

(2) Pacific Region

Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Consequently, impacts on air quality in the Pacific Region would remain unchanged from Alternative I. Section IV.D.1.a(2) provides a discussion of potential impacts on air quality in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

The effects of emissions associated with the seven platforms on acid deposition are expected to be negligible. This is based on the expected rate of emissions of NO_2 and SO_2. These emissions are only a small fraction of existing emissions of those pollutants in the southern California area.

It is assumed that one pipeline spill of an estimated 7,000 bbl of oil will occur as a result of the Alternative VIII. An event such as this would have the potential to create air quality problems in the vicinity of the spill for the duration of the spill. However, onshore effects are highly dependent on the distance offshore, and weather conditions at the time. Spills greater than 3 miles from shore are unlikely to have long term, measurable effects on onshore air quality.

Three tanker spills of 30,000 bbl each are assumed to occur along the tanker route in the Pacific Region from Alaskan production. In the event of a tanker spill, total emissions for each spill during the first and second hour would be 1,710,000 lbs and 870,000 lbs respectively. In the event the spill occurs nearshore, impacts to the Washington and southern California areas could result in short-term exceedance of the onshore standard. Effects would not be discernable for the spill off northern California since it is assumed to be further offshore.

CONCLUSION: Adoption of Alternative VIII is expected to result in emissions of NO_x, and RHC, which cause localized increases in O_3 concentrations since routine activities remain the same as in

Alternative I in the southern California planning area. These increases are estimated to be less than 5 percent of the existing onshore emissions. However, the status of the onshore counties as non-attainment for ozone and implementation of the new Clean Air Act are likely to result in a requirement for total offsets of all RHC and NO_x emissions produced. The result will be no net increase in the levels of air pollution emissions within the Pacific OCS Region Planning Area.

In the event of an accidental spill, local air quality standards off the Washington and southern California planning areas in the vicinity of the spill will be temporarily exceeded. These exceedances are expected to last for the duration of a spill, but are not expected to result in long term effects to onshore air quality.

c. Impacts on Marine Mammals

(1) Alaska Region

(a) Threatened or Endangered Species

1) Cetaceans

a) Bowhead Whale

Bowhead whales occur in the Bering Sea during the winter period (generally November to April). During this time, they are widely dispersed in the Bering Sea in U.S. and Russian waters but are generally south of Hope Basin. Hence, this alternative would result in fewer winter encounters with industrial noise and crude oil than would occur in the Alternative I base-case analysis, which includes a sale in Navarin Basin rather than Hope Basin. However, it also would increase the number of spring encounters with production related noise and crude oil, since most bowheads migrate north through the Hope Basin. The magnitude of this increase would depend on specifically where production operations occur, specifically where and when ice leads form in any given year, the specific migratory route bowheads choose in any given year, and the time period when they pass through these leads. The encounter rate would depend on how these variables combine during each spring migration. Industrial noise and oil associated with exploration would have no effect on bowheads, because these operations are limited by ice and do not begin until after the spring bowhead migration already has passed through the area. The effects of industrial noise and crude oil on cetaceans were discussed in Section IV.D.1.a(3).

CONCLUSION: Based on the assumptions for Alternative VIII, it is estimated that this alternative would have sublethal effects on up to 10 percent of the bowhead population in winter (the oil industries activities are restricted in the winter because of the presence of ice) and up to 100 percent in spring due to production-related noise and oil spills. None of these effects are expected to affect recruitment or distribution of the species.

b) Fin and Humpback Whales

Industrial noise and crude oil from both exploration and production operations would affect fin and humpback whales, because they may use the same area during the same time period. However, fin and humpback whales are more likely to occur in the central Bering Sea than the northern Bering Sea. Hence, leasing in Hope Basin would result in fewer whales encountering industrial noise and crude oil than would occur in Alternative I base-case analysis, which includes a sale in Navarin rather than Hope Basin. The effects of industrial noise and crude oil on cetaceans were discussed in Section IV.D.1.a(3).

CONCLUSION: Based on the scenario for Alternative VIII, noise associated with OCS activities is estimated to have sublethal effects on less than 5 percent of fin and humpback populations rather than 20 percent as estimated for Alternative I. Sublethal effects due to oil spills would be the same as Alternative I, affecting up to 10 percent of the population over the 30 to 35 year life of the proposed action. None of these effects is expected to affect recruitment or distribution of the species.

c) Right, Blue, Sei, and Sperm Whales

Industrial noise and accidental crude oil spills from both exploration and production operations would affect right, blue, sei, and sperm whales, because they may use the same area during the same time period. The effects of industrial noise and crude oil on these cetaceans are short-term and are described in Section IV.D.1.a. These species are more likely to occur in the central Bering Sea than in the northern Bering Sea. Therefore, impacts are expected to be some what less than those described for Alternative I.

CONCLUSION: Based on the scenario for Alternative VIII, noise associated with OCS activities is estimated to have sublethal effects on less than 5 percent of the right, blue, sei and sperm whale populations rather than 10 percent as estimated for Alternative I. Oil spills are estimated to affect up to 5 percent of the population over the 30 to 35 year life of the proposed activities. None of these effects is expected to affect recruitment or distribution of the species.

2) Pinnipeds

STELLER SEA LION: Specific impacts expected to be experienced by the Steller sea lion from activities occurring in St. George Basin are included in Alternative I (Section IV.D.1.a). The principal changes resulting from a substitution of OCS activity in Hope Basin for development in Navarin Basin are a shift of an assumed tanker spill and potentially disturbing activities (helicopter and vessel traffic, construction, spill containment and cleanup) from the Navarin Basin to the Hope Basin area and location of a 90 mile oil pipeline in this area. Steller sea lions are found in relatively small numbers (a few hundred representing less than 1% of the Alaskan population) in the Navarin Basin area, although several hundred may reach St. Lawrence Island in late summer. Because Steller sea lions do not typically occur in the northern Hope Basin, this alternative is expected to result in fewer impacts than the proposal on the Bering Sea segment of the Alaskan population through elimination of both disturbance from seismic and construction activities and a tanker spill and subsequent cleanup disturbance from the Navarin Basin (although adults probably are not acutely sensitive to oil). Under normal circumstances, such a relatively small reduction in potential impacts would constitute an insignificant change in the overall impact on the population; however, it could prove to be more important in this species where numbers have declined precipitously in recent decades.

Although some reduction in overall impact on the Alaskan Steller sea lion population from disturbance and oil spills is expected to result from this alternative, the numbers involved (less than 1% of the population) and the fact that the effect of a minor reduction is likely to be lost in the overall precipitous decline of this species suggest that this alternative will not result in an impact level significantly different from Alternative I.

CONCLUSION: Based on the scenario for Alternative VIII, it is expected that Steller sea lions would sustain impacts from disturbance and exposure to accidental oil spills. Recovery from these impacts is expected to require more than three generations (more than 18 years) for the Alaskan population and two generations (12 years) for that portion of the population occupying areas south of Alaska.

(b) Nonendangered Species

1) Cetaceans

a) Beluga Whale

The effects of oil and gas activities on beluga whales from leasing in the St. George are discussed for Alternative I under Section IV.D.1.a(3) and Appendix F, respectively. The Bristol Bay population of beluga whales is thought to use the St. George Basin planning area during July-October. One tanker spill is assumed to occur in the St. George Basin (37% probability of one or more spills of 1,000 bbl or greater occurring). It is assumed to occur near or within Unimak Pass or offshore of the mainland. Oil that might reach and contact beluga whales in offshore areas would disperse quickly and few whales (perhaps 10 to less than 100) are likely to be seriously affected.

Belugas that migrate from the Bering Sea to Kasegaluk Lagoon in the Chukchi Sea, and to the Mackenzie Delta and eastern Beaufort Sea pass through Hope Basin twice each year. Leasing in Hope Basin is assumed to result in one tanker spill (47% probability of one or more spills of 1,000 bbl or greater occurring). This spill is assumed to occur in the Bering Strait area and contaminate the lead system used by the whales during the spring, but only a small number of whales (perhaps 10 to less than 100) are expected to be seriously affected and represent less than losses due to natural mortality. This effect would be the same as the effects the whales are expected to experience in the Beaufort and Chukchi Sea Planning Areas under Alternative I.

There is a possibility that offshore routine oil and gas activities and/or accidental oil spills could occur in both the St. George and Hope planning areas sometime during the 30-year life of the proposal. However, it is unlikely that oil spills would occur in both areas concurrently, which potentially could produce additive or multiple adverse effects on beluga whales migrating through these two areas. If the majority of the St. George-Bristol Bay beluga population remain in this area during July-October, they are unlikely to be affected by activities or spills in the Hope Basin area. However, if the majority of the Bering-Chukchi-Beaufort beluga whale population migrates through the Hope Basin area about the same time period as the weather window for offshore operations, they would potentially have a greater level of exposure to routine oil and gas activities and/or accidental spills for a longer time period.

CONCLUSION: Based on the scenario for Alternative VIII, the primary effects on beluga whales are expected to come from noise and disturbance, especially icebreaking activities, other marine-vessel traffic, and oil spills. Noise and disturbance from icebreakers and other marine traffic are expected to temporarily (a few days to less than 3 years) displace or interfere with beluga whale movements within a few to several miles of the activities. Few beluga whales are likely to die from contact with the oil spills. The loss of beluga whales from the assumed oil spills (perhaps 10 whales or less) in the Alaskan populations is expected to be less than the losses due to natural mortality such as losses from disease, predation, and subsistence harvest. There is an 18 to 57 percent chance of one or more spills of 10,000 bbl or greater occurring throughout the range of the beluga whale over the 30-year life of the proposal.

b) Minke Whale

Under Alterative VIII, routine activities and accidental events are generally at the same level as Alternative I. The principal change in the scenario, resulting from substituting a Hope Basin lease sale for a Navarin Basin lease sale, is a shift of an assumed tanker spill and exploration and development activities. Minke whale numbers are considered low in the Hope Basin area. Impacts to the minke whale in Hope Basin would be negligible. The substitution of the Hope Basin is not expected to cause a measurable change in the potential impacts analyzed under Alternative I. Section IV.D.1.a provides a discussion of the potential impacts on the minke whale population and an analysis of the impacts expected as a result of Alternative I.

CONCLUSION: The adoption of Alternative VIII is expected to displace minke whales from a few square kilometers of summer feeding areas in the Alaska Region as the result of exploration and development activity over the life of the alternative, but no disruption of minke whale movements through the Alaska and Pacific Regions is expected. No minke whale mortality is expected as a result of accidental oil spills. Any changes in numbers or distribution as a result of displacement from the area of an oil spill are expected to last no more than a few months. The probabilities of one or more oil spills of 10,000 bbl or greater occurring in the Alaska and Pacific Regions range from 14 to 81 percent.

2) Pinnipeds

a) Northern Fur Seal

Impacts expected to be experienced by the northern fur seal from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers, if any, of this species in Hope Basin, the analysis and resulting conclusion will remain the same for Alternative VIII as described in Alternative I.

CONCLUSION: Based on the scenario for Alternative VIII, disturbance associated with the alternative is expected to result in some loss of fur seal productivity and elevated pup mortality. Where fur seals are relatively concentrated, in the vicinity of the Pribilof Islands in summer and fall, during peak passage of migrants through Unimak Pass and at San Miguel Island during the breeding season, oil spills associated with Alternative VIII are expected to result in losses (probably exceeding 5,000 individuals) requiring three or more generations (more than 12 years) for recovery. Where densities are substantially lower farther from the islands, along the migration route, and in wintering areas, mortality experienced by this species is expected to be less and thus require only a generation (4-6 years) for the population to return to its initial status. There is an 18 to 34 percent probability that one or more oil spills of 10,000 bbl or greater will occur in the planning areas occupied by fur seals over the life of the proposal.

b) Ice Seals

Impacts expected to be experienced by the four species of ice seals from activities occurring in St. George Basin are included in Alternative I (Section IV.D.1.a). The principal changes resulting from a substitution of OCS activity in Hope Basin for development in Navarin Basin are a shift of an assumed tanker spill and potentially disturbing activities (helicopter and vessel traffic, construction, spill containment and cleanup) from the Navarin Basin to the Hope Basin area and location of a 90 mile oil pipeline in this area. These changes are expected to shift some proportion of potential impacts from ribbon and spotted seal populations that are concentrated in the central Bering Sea for part of the year to bearded and ringed seal populations in the northern Hope Basin. The magnitude of this shift remains speculative because all four species occupy both areas in varying proportion for at least part of the year, and some proportion of all four populations move between Bering and Chukchi Seas on an annual basis. If Alternative VIII is adopted, the principal beneficiary would appear to be the ribbon seal, most of which remain in the Bering Sea year-round, because potential oil spills and disturbance would be more likely in an area where bearded and ringed seals are more concentrated for much of the year and where spotted seals may occur in higher numbers during the open-water season.

Because adults and adults with young are widely dispersed for most of the year, helicopter flights and vessel traffic associated with this alternative are not expected to disturb a major proportion of these seal populations or result in substantial effects on their distribution or migration. Although assumed oil spills associated with this alternative could result in some mortality among newborn or severely stressed adult ice seals, such incidents are not expected to cause losses exceeding a few hundred individuals in an estimated total Alaskan population of the four species exceeding 1.5 to 2 million.

CONCLUSION: Based on the scenario for Alternative VIII, it is expected that no more than a few hundred ice seals would be lost. It is also expected that less than one generation (4-7 years) would be required for recovery to the original population status from either noise disturbance or oil-spill effects. Less than 1 percent of these four populations is expected to be adversely affected by this alternative.

c) Harbor Seal

Impacts expected to be experienced by harbor seals from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers, if any, of this species in Hope Basin, the analysis and resulting conclusion will remain the same for this alternative as described in Alternative I.

CONCLUSION: Under Alternative VIII, recovery of harbor seals from any support air traffic impacts is not expected to exceed one generation (4 to 6 years). Although oil spills assumed for Alternative VIII are not expected to result in much adult harbor seal mortality, pup mortality among those contacted by oil may be substantial, probably involving up to 200 individuals and require one generation or more for recovery. There is a 14 to 34 percent probability of one or more oil spills of

10,000 bbl or greater occurring in the planning areas occupied by harbor seals over the 30-year life of the proposal.

d) Pacific Walrus

Impacts expected to be experienced by the Pacific walrus from activities occurring in St. George Basin are analyzed in Alternative I (Section IV.D.1.a). Routine offshore oil and gas exploration in the Hope Basin would cause potentially disturbing helicopter and vessel traffic, the construction of 90 miles of oil pipeline, an assumed accidental tanker spill, and the attendant spill containment and cleanup activities.

Shifting offshore activities from the Navarin Basin to the Hope Basin is expected to shift some of the above impacts from walruses that are concentrated in the central Bering Sea (Navarin Basin) in winter and spring to those that migrate through the northern Hope Basin in late spring and fall. A large proportion of the walrus population migrates between Bering and Chukchi Seas on a seasonal basis. It is likely that many of the same walrus (perhaps up to 60% of the walrus wintering between St. Matthew and St. Lawrence Islands) occupy both the Navarin and Hope Basins at different times of year. The summer range of the male Pacific walrus includes the northern portion of the St. George Basin and the summer range of adult female and juvenile Pacific walrus includes portions of the Hope Basin planning area. Because the Pacific walrus seasonally migrate through several arctic and subarctic planning areas they are more likely to be contacted or affected by offshore activities. Conversely, because groups of adults and adults with calves are widely dispersed for most of the year, helicopter flights and vessel traffic associated with this alternative are not expected to disturb or result in mortality of a significant proportion of the walrus population, perhaps a few hundred individuals, or result in substantial effects on its distribution or migration. Although oil spills assumed to result from this alternative could result in some mortality among calves or severely stressed adults, such incidents are not expected to cause losses exceeding one hundred individuals in an estimated Alaskan population of 250,000.

CONCLUSION: Based on the scenario for Alternative VIII, it is expected that no more than 100 individual walruses would be lost. Thus, impacts on walruses from Alternative VIII are expected to be approximately the same as Alternative I, requiring no more than one generation (8-10 years) for recovery to the original population status from either disturbance or oil-spill effects. Less than 1 percent of the walrus population is expected to be adversely affected by this alternative.

3) Sea Otter (Alaska Population)

Impacts expected to be experienced by the sea otter from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(3). Because of the low population numbers of this species in Hope Basin, the analysis and resulting conclusion will remain the same for this alternative as described in Alternative I.

CONCLUSION: Based on the scenario assumptions for Alternative VIII, oil spills are expected to cause mortality of up to 500 individuals requiring two generations (a generation is equal to 3 to 5 years) or more for recovery. Disturbance from oil-spill-cleanup activities is expected to cause a local abandonment of habitat for a variable period and require up to a generation for recovery. There is a 21 to 34 percent probability of one or more spills of 10,000 bbl or greater occurring in planning areas where sea otters could be affected over the 30-year life of the proposal.

4) Polar Bear

Impacts expected to be experienced by the polar bear from activities occurring in St. George Basin are included in Alternative I (Section IV.D.1.a). The principal changes resulting from a substitution of OCS activity in Hope Basin for development in Navarin Basin are a shift of an assumed tanker spill and potentially disturbing activities (helicopter and vessel traffic, construction, spill containment and cleanup) from the Navarin Basin to the Hope Basin area and location of a 90 mile oil pipeline in this area. These changes are expected to shift some proportion of potential impact from the relatively small numbers of polar bears that occur in the central Bering Sea in winter and spring (probably fewer than 100 individuals) to the larger numbers that occupy and/or migrate through the northern Hope Basin (perhaps several hundred). The magnitude of this shift remains speculative because the numbers occupying these two areas are not well known and highly variable. It also is likely that some of the same individuals (perhaps up to 50% of the individuals wintering between St. Matthew Island and Hope Basin) occupy both areas at different times of year as a result of virtually all polar bears present in the Bering and southern Chukchi Seas moving through the Chukchi Sea as the seasonal pack ice retreats each year. From a consideration of the numbers of bears potentially involved, there appears little doubt that impacts would be elevated by development in Hope Basin instead of Navarin Basin.

Because individuals typically are widely dispersed, helicopter flights and vessel traffic associated with this alternative are not expected to disturb a significant proportion of the polar bear population, perhaps up to a few hundred individuals, or result in substantial effects on its distribution or migration. Although the potential for den disturbance is higher in the Hope Basin than in the Navarin Basin area, few dens are expected to be disturbed over the life of the field. Oil spills associated with this alternative could result in some mortality, particularly where bears may be concentrated near seal concentrations, but such incidents are not expected to cause losses exceeding some tens of individuals in an estimated Alaskan population of 3,000 to 5,000.

CONCLUSION: Impacts on polar bears from Alternative VIII are expected to be greater than Alternative I, requiring more than one generation (5+ years) for recovery to the original population status from combined disturbance and oil-spill effects. Mortality resulting from spill contact of bear concentrations at food sources is expected be greater than 25 individuals (up to 50) in a population of 3,000 to 5,000 individuals to require substantially more than one generation for recovery. Two percent of the population or less is expected to be affected adversely by this alternative.

(2) Pacific Region

(a) Threatened or Endangered Species

1) Cetaceans

GRAY WHALE: Under Alternative VIII, the scenario in the Pacific Region remains unchanged from Alternative I. However, the principal change in the scenario, resulting from substituting a Hope Basin lease sale for a Navarin Basin lease sale, is a shift of an assumed tanker spill and exploration and development activities. Although the Hope Basin area contains a large portion of the summer feeding grounds of the gray whale, impacts are expected to be similar to those described under Alternative I. Most effects would be temporary and sublethal. Accidental oil spills are expected to result in the death of a few individuals on the summer feeding rounds. This level of mortality would be indistinguishable from natural variability in the gray whale population. Section IV.D.1.a provides a discussion of the potential impacts on the gray whale population and an analysis of the impacts expected as a result of Alternative I.

CONCLUSION: The adoption of Alternative VIII is expected to result primarily in sublethal effects on the gray whale population involving changes in abundance and distribution lasting a year or less. A few mortalities will occur due to accidental oil spills. This level of mortality is not expected to be distinguishable from natural variability within the gray whale population. There is a 14 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring throughout the range of the gray whale over the 30-year life of the alternative.

2) Pinnipeds

GUADALUPE FUR SEAL: Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to the Guadalupe fur seal would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the Guadalupe fur seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on Guadalupe fur seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the Guadalupe fur seal population.

Two spills of 1,000 bbl or more are assumed to occur off southern California under this alternative. Since a small, undetermined number of Guadalupe fur seals are probably present in these waters at any one time, it is possible that such a spill would contact and kill a few individual fur seals. This level of mortality would not be distinguishable from natural variability within the population.

CONCLUSION: Adoption of Alternative VIII is expected to have no discernable effect on Guadalupe fur seal abundance and distribution.

3) Sea Otter (Pacific Population)

Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to the California and Washington sea otter populations would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the sea otter populations in the Pacific Region and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea otters include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. Routine operations associated with Alternative I are not expected to impact the California or Washington sea otter populations.

Three oil spills of 1,000 bbl or more are assumed to occur in the Pacific Region and to contact the shoreline under this alternative: one off the coast of Washington, and two off southern California. An oil spill of this size contacting the sea otter populations in either of these areas would result in mortality and temporary loss of habitat. Assuming a pipeline spill and contact to the California mainland range, the death of up to 250 sea otters is expected, and recovery of the California sea otter population would take up to 3 years. Assuming a spill and contact to San Nicolas Island, the translocated sea otter population would probably be eliminated. Assuming a spill and contact to the Washington range, tens of otters would die, and recovery of the Washington sea otter population would possibly take more than 5 years.

CONCLUSION: Adoption of Alternative VIII is expected to have lethal effects on sea otter populations in the Pacific Region. Mortality of is expected to occur as the result of accidental oil spills; population recoveries will take 3 years or more. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is a up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Nonendangered Species

1) Cetaceans

a) Killer Whale

Under Alterative VIII, routine activities and accidental events are generally at the same level as Alternative I. The principal change in the scenario, resulting from substituting a Hope Basin lease sale for a Navarin Basin lease sale, is a shift of an assumed tanker spill and exploration and development activities. Killer whale numbers appear to be relatively low in the Hope Basin area. No killer whale mortality due to accidental oil spills is expected in the open waters of Hope Basin. However, the substitution of the Hope Basin is not expected to cause a measurable change in the potential impacts analyzed under Alternative I. Section IV.D.1.a provides a discussion of the potential impacts on the killer whale population and an analysis of the impacts expected as a result of Alternative I.

CONCLUSION: Routine activities from Alternative VIII are expected to have no measurable effects on the killer whale population. The major impacting factor is expected to be spilled oil. Assuming a spill occurrence and contact, oil spills are expected to result in the death of a few killer whales in protected Alaskan waters. This level of mortality is expected to be indistinguishable from natural variability within the killer whale population. There is a 34 percent probability that one or more oil spills of 10,000 bbl or greater will occur from production in the Gulf of Alaska. There is also up to an 81 percent probability that one or more oil spills of 10,000 bbl or greater will occur along the tanker route.

b) Harbor Porpoise

Under Alterative VIII, routine activities and accidental events are generally at the same level as Alternative I. The principal change in the scenario, resulting from substituting a Hope Basin lease sale for a Navarin Basin lease sale, is a shift of an assumed tanker spill and exploration and development activities. Harbor Porpoise numbers are quite low in the Hope Basin Planning Area. Harbor porpoises in this area, therefore, are not expected to be measurably affected by either routine activities or accidental oil spills. The substitution of Hope Basin is not expected to cause a measurable change in the potential impacts analyzed under Alternative I. Section IV.D.1.a provides a discussion of the potential impacts on the harbor porpoise population and an analysis of the impacts expected as a result of Alternative I.

CONCLUSION: Under Alternative VIII, routine exploratory and development activities are expected to result in the displacement of harbor porpoises from a few square kilometers of nearshore habitat in Cook Inlet and the Gulf of Alaska for a period of several months during pipeline construction. The major impacting factor is expected to be spilled oil. Assuming occurrence and contact oil spills are expected to result in the loss of a few harbor porpoises and the possible displacement of animals from the area of the spill for several months. This level of mortality is expected to be indistinguishable from natural variability in the harbor porpoise population. The probabilities of one or more spills of 10,000 bbl or greater occurring in harbor porpoise areas in Alaska and along the Washington coast range from 18 to 81 percent.

2) Pinnipeds

a) Northern Elephant Seal

Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to the northern elephant seal would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts to the northern elephant seal population and an analysis of the impacts expected as a result of Alternative I.

Routine exploratory and development activities that could have impacts on elephant seals include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are expected to have no detectable effect on the northern elephant seal population.

If one of the oil spills assumed to occur off southern California under this alternative were to contact the rookery beaches on San Miguel or San Nicolas Island during the species' winter breeding season, some pup mortality could occur. Assuming occurrence and contact, accidental oil spills are expected to result in the death of a few (less than 20) elephant seal pups. This level of mortality would not be distinguishable from natural variability within the elephant seal population.

CONCLUSION: Adoption of Alternative VIII is expected to result primarily in sublethal effects on the northern elephant seal population. A few mortalities (less than 20) are expected to occur due to accidental oil spills. No discernable changes will occur in northern elephant seal abundance or distribution.

b) California Sea Lion

Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to California sea lions would remain the same. Section IV.D.1.a(3) provides a discussion of potential impacts on the California sea lion population and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on California sea lions include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact the California sea lion population.

Two oil spills of a 1,000 bbl or more are assumed to occur off southern California under this alternative. An oil spill of 1,000 bbl or more contacting a California sea lion rookery during the species' summer breeding season would result in pup mortality. Assuming a spill during the summer and contact to one of the rookeries, it is possible that tens to hundreds of sea lion pups would die. Recovery of the California sea lion population from such a loss is expected to take 3 years or less.

CONCLUSION: Adoption of Alternative VIII is expected to result primarily in sublethal effects on the California sea lion population. Some mortality (of tens to hundreds of pups) is expected to occur due to accidental oil spills. Population recovery will take no more than 3 years. No discernable changes in California sea lion distribution will occur. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative.

d. Impacts on Terrestrial Mammals

ALASKA REGION: Caribou. The principal changes resulting from a substitution of OCS activity in Hope Basin for development in Navarin Basin are a shift of an assumed tanker spill and potentially disturbing activities (helicopter and vessel traffic, construction, spill containment and cleanup) from the Navarin Basin to the Hope Basin area, and location of a 90 mile oil pipeline in this area. Although oil and gas activities in the Navarin Basin would not affect caribou, activities assumed for the Hope Basin lease sale could potentially impact the Western Arctic caribou herd. The full extent of this impact remains somewhat speculative because the numbers of animals wintering adjacent to the Hope Basin is not well known and highly variable. Because much of the primary wintering range of this herd (generally near the base of the Seward Peninsula and east) lies well to the south of areas adjacent to Hope Basin, and only those relatively few individuals occupying areas near the coast are likely to be affected, impacts are not expected to be significantly greater than those associated with Alternative I.

Because a relatively small proportion of the Western Arctic herd is likely to occupy the Hope Basin area, helicopter flights and construction or other activity associated with this alternative are expected to disturb only small numbers (few hundred or less) of caribou and not cause substantial alteration of their distribution or migration. Oil spills associated with this alternative could result in some mortality if caribou consumed contaminated vegetation on beaches; however, losses are not expected to exceed a few individuals in a population of 340,000.

CONCLUSION: As a result of minor disturbance and oil-spill impacts on caribou wintering adjacent to Hope Basin, impacts on caribou from Alternative VIII are expected to be insignificantly greater than Alternative I, requiring no more than two generations (6 to 10 years) for recovery to the original population status. Considerably less than 1 percent of the population is expected to be adversely affected by this alternative.

e. Impacts on Marine and Coastal Birds

(1) Alaska Region

(a) Threatened or Endangered Species

1) Arctic and American Peregrine Falcons

In the Bering Sea area, the Alternative I assessed impacts in the St. George and Navarin Basins (Section IV.D.1.a). Alternative VIII would be the same in the Bering Sea area, except that it would substitute Hope Basin for Navarin Basin. The coastal area of Hope Basin is likely to be used by peregrine falcons, whereas the Navarin basin has no coastal habitat and is not used by peregrine falcons. Hence, Alternative VIII would increase the number of peregrine encounters with industrial noise and crude oil over that of Alternative I. The effects of industrial noise and crude oil on peregrine falcons can be lethal and were discussed in Section IV.D.1.a(5).

CONCLUSION: Under the scenario for Alternative VIII, and based on the distribution of peregrine falcons in relation to OCS activities, noise associated with OCS activities is estimated to lead to abandonment of 60 percent of peregrine falcon nest sites compared to the 50 percent estimated for Alternative I. Oil spills also would be estimated to affect 60 percent of the population, more than was estimated for Alternative I (50%). This decline in species numbers would last more than 6 years.

2) Short-Tailed Albatross

While there are no known areas where short-tailed albatrosses concentrate within their summer range, most sightings have been in the southern Bering Sea and Gulf of Alaska. Hence, northern variations (Hope Basin in this case) may afford a small advantage for the short-tailed albatross over that of Alternative I by reducing the probability of an encounter with OCS activities. However, due to the low number of sightings expected, Alternative VIII is expected to have similar effects as Alternative I. The effects of industrial noise and crude oil on short-tailed albatross can be lethal, and were discussed in Section IV.D.1.a(5).

CONCLUSION: Under the scenario for Alternative VIII, and based on the distribution of the short-tailed albatross in relation to OCS activities, noise and crude oil associated with OCS activities are estimated to have similar effects as estimated for Alternative I (sublethal effects on 2%, lethal effects on up to 25%).

(b) Nonendangered Species

1) Bald Eagle (Alaska Population)

Impacts expected to be experienced by the bald eagle from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(5). Because of the low population numbers, if any, of this species in Hope Basin, the analysis and resulting conclusion will remain the same as described in Alternative I.

CONCLUSION: Based on the scenario for Alternative VIII, routine activities associated with development are expected to disturb fewer than 25 pairs of nesting eagles and require the equivalent of one generation (minimum of 5 years) for recovery of any loss in productivity. Under the proposed program, the assumed tanker spills in the Gulf of Alaska, where the bald eagle population is concentrated, are expected to cause mortality potentially involving a loss of 50 to 75 individuals requiring a minimum of three generations (15 years) for recovery. There is an 18 to 34 percent probability of one or more oil spills of 10,000 bbl or greater occurring due to OCS activities in the Cook Inlet and Gulf of Alaska planning areas over the 30-year life of the proposal.

2) Waterfowl

Impacts expected to be experienced by waterfowl from activities occurring in St. George Basin are included in Alternative I (Section IV.D.1.a). The Izembek and Nelson Lagoons along the northern coast of the Alaskan Peninsula in the St. George Basin are important wintering areas for several species of eiders and the fall staging areas for the Pacific black brant. Brant are easily disturbed by aircraft overflights. If aircraft operations to support activities in the St. George Basin are based in Cold Bay, the aircraft overflights would adversely affect eiders and brant in the Izembek Lagoon area (Section IV.D.1.a.(5)). The changes resulting from a substitution of OCS activity in Hope Basin for development in Navarin Basin are a shift of an assumed tanker spill and potentially disturbing activities (helicopter and vessel traffic, construction, spill containment and cleanup) from the Navarin Basin to the Hope Basin area and location of a 90 mile oil pipeline in this area. Because of these changes some proportion of the expected impacts to waterfowl that overwinter in the central and northern Bering Sea (chiefly diving ducks in the St. Matthew and St. Lawrence Island polynyas, along the ice edge, or in the ice front) would no occur. However, similar impacts are expected for those waterfowl that winter in or migrate through the northern Hope Basin. The magnitude of this shift remains speculative, because it is likely that many of the same individuals (perhaps up to 50%) may pass through the Hope area during migration. More importantly, substantial numbers (tens of thousands annually) of diving ducks molt and/or overwinter in the Hope Basin area, and extremely large numbers (hundreds of thousands to well over 1 million) traverse this area during spring and fall migrations.

Helicopter and vessel traffic is expected to disturb only small numbers of individuals (perhaps hundreds) for short intervals and not cause long-term alteration of distribution or migration or result in other than negligible mortality. Impact of an oil spill in Hope Basin, however, is expected to cause substantial mortality ranging from thousands of individuals if contact is in winter, to tens of thousands or more if contact is during migration. Such losses are expected to require several generations (2 to 4 years each) for recovery to the original population status, particularly in the case of species whose populations are declining such as Steller's and spectacled eiders.

CONCLUSION: Shifting of potential oil-spill and disturbance effects from Navarin Basin to Hope Basin is expected to result in a significant elevation of impact for several regional waterfowl populations. However, overall impacts on waterfowl resulting from Alternative VIII are expected to be approximately the same as Alternative I, requiring up to several generations (perhaps 9 years) for recovery to the original population status from oil- spill and disturbance effects. Less than 3 percent of the regional waterfowl population is expected to be adversely affected by this alternative.

(2) Pacific Region

(a) Threatened or Endangered Species

1) Bald Eagle (Pacific Population)

The routine activities and accidental events assumed to occur in the Pacific OCS Region under Alternative VIII do not change from that described for Alternative I. As with Alternative I, given the extremely rare occurrence of bald eagles along the southern California coast, impacts to this species from routine activities associated with Alternative VIII are not expected to occur.

A generic discussion of the possible impacts of accidental oil spills on bald eagles is presented in Section IV.D.1.a(5). Based on the severe impacts of the *Exxon Valdez* oil spill on the Prince Williams Sound population of bald eagles in Alaska (see Section IV.D.1.a), an oil spill along the coast of southern California related to Alternative VIII could result in eagle mortality. However, due to the extreme rarity of this species along the southern California coast, the accidental pipeline or Alaskan tanker oil spill assumed to occur as a result of Alternative VIII is not expected to impact this species.

A 30,000 bbl Alaskan tanker spill is also assumed to occur within the Pacific OCS Region, off Washington state. A small population (roughly 60-70 pairs) of eagles occurs year-round along the coast of Washington, and a portion of this population could potentially be at risk from a tanker spill. If a tanker spill were to contact the Washington shore or if marine birds and/or mammals were oiled and washed ashore, some eagles could be oiled and mortality could occur. Given the analytical assumptions identified for Alternative VIII, tens of eagles are expected to be lost as a consequence of a spill contacting the Washington coast. Because of the relatively slow population growth rates of bald eagles, recovery in this area could take up to 4 years.

CONCLUSION: Routine activities and accidental oil spills assumed to occur as a result of Alternative VIII in the Southern California Planning Area are not expected to have an impact on threatened or endangered populations of bald eagles. An Alaskan tanker spill of 30,000 bbl off the coast of Washington is expected to result in injury and mortality of bald eagles. Assuming a spill contacted the Washington shoreline, tens of eagles are expected to be lost, with recovery taking up to 4 years. There is a up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

2) California Least Tern

Disturbances to least terns may arise from those activities assumed for the Pacific OCS Region under Alternative VIII that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on least terns (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from Alternative VIII within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Since no new onshore facilities are planned for the Pacific OCS Region under Alternative VIII and tern colonies are few in number and widely distributed, impacts from air traffic are expected to be negligible.

As with most birds, California least terns are vulnerable to the effects of oil contact. As outlined in Alternative I analysis (Section IV.D.1.a(5)), if an oil spill occurred from May to September and was in the vicinity of a tern colony, as many as 50 pairs or about 5 percent of the population could be affected. Recovery is expected to take 2-4 years.

CONCLUSION: Routine OCS-related activities assumed for Alternative VIII are not expected to have an impact on California least terns. The principle impacting agent under Alternative VIII is oil from an assumed and/or an Alaskan tanker spill. Expected outcome of spill contact with a tern colony are loss of up to 50 pairs (5% of the population) and disruption of the colony's reproductive cycle for that year. Recovery is expected to take 2-4 years. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

3) California Brown Pelican

Disturbances to California brown pelicans may arise from several activities assumed to occur in the Pacific OCS Region under Alternative VIII, including vessel and air traffic, platform and pipeline construction, and platform removal. Other activities associated with offshore oil and gas activities are either not expected to have an effect on California brown pelicans (geophysical surveys and platform discharges) or are not projected to occur from Alternative VIII within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

The effect of routine OCS-related oil and gas activities on brown pelicans is expected to be limited to the temporary displacement (i.e., a few days) of a few individuals resting or foraging near platform/pipeline construction sites.

A generic discussion of the possible impacts of accidental oil spills on California brown pelicans is presented in Section IV.D.1.a(5). Because this species forages at sea and sometimes rests on the water, brown pelicans could potentially be vulnerable to the effects of spilled oil. In addition, brown pelicans are often concentrated in nearshore waters, conceivably exposing numerous individuals to a given oil spill. Based on the oil spills of 1,000 bbl or more assumed to occur in the Southern California Planning Area under Alternative VIII, from 50 to as many as 1,000 adult pelicans could be oiled, with mortality ranging from 20-50 percent of birds contacted. If a spill occurred during the breeding season and contacted a pelican nesting area, major disruptions in reproduction could be expected, with the potential loss of up to 25 percent of active nests. Recovery could be expected within 1 to 4 years.

CONCLUSION: The effect on brown pelicans from routine OCS-related oil and gas activities assumed to occur as a result of Alternative VIII in the Southern California Planning Area is expected to be limited to the temporary displacement (e.g., a few days) of a few individuals resting or foraging near platform/pipeline construction sites. The principle impacting agent in the Southern California Planning Area is oil from an assumed pipeline spill and/or a tanker spill. From 50 to 1,000 pelicans are expected to be oiled, with mortality occurring in 20 to 50 percent of those contacted; recovery is expected in 1 to 4 years. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

4) Light-Footed Clapper Rail

Disturbances to light-footed clapper rails may arise from those activities assumed for the Pacific OCS Region under Alternative VIII that can occur in close proximity to the shoreline, mainly air traffic. Other activities associated with oil and gas operations are either not expected to have an effect on light-footed clapper rails (vessel traffic, geophysical surveys and platform discharges) or are not projected to occur from this alternative within the range of this species (pipeline landfalls, onshore support-facility construction and operation).

Since no new onshore facilities are planned for the Pacific OCS Region under Alternative VIII and marshes occupied by this species are few in number and widely distributed, impacts from air traffic are expected to be negligible.

As with most birds, light-footed clapper rails are vulnerable to the effects of oil contact. Since light-footed clapper rails seasonally breed in about 14 widely-spaced marshes from Santa Barbara to the Mexican border (USDOI, FWS, 1980b), an oil spill would have to occur and contact the birds at one of these sites. This is considered unlikely, however, as protective equipment (e.g., oil booms) is readily available throughout the rail's range, and oil can generally be prevented from entering estuaries and marshes. Nevertheless, if an oil spill should occur and contact a rail marsh, some mortality is expected. Depending on various factors (spill date, spill size, weather, distance from shore), the impact on light-footed clapper rails could range from a few individuals to the loss of this species from an entire marsh. Due to the continued depressed population of this species, the loss of more than a few individuals could be significant, requiring from 2 to as much as 6 or 7 years to recover.

CONCLUSION: Routine activities and accidental oil spills assumed to occur as a result of Alternative VIII are not expected to have an impact on light-footed clapper rails.

(b) Nonendangered Species

1) Seabirds

Impacts expected to be experienced by seabirds from activities occurring in St. George Basin are included in Alternative I (Section IV.D.1.a). The principal changes resulting from a substitution of OCS activity in Hope Basin for development in Navarin Basin are a shift of an assumed tanker spill and potentially disturbing activities (helicopter and vessel traffic, construction, spill containment and cleanup) from the Navarin Basin to the Hope Basin area and location of a 90 mile oil pipeline in this area. Because of these changes some proportion of the expected impacts to seabirds that overwinter in the central and northern Bering Sea (chiefly murres in the St. Matthew and St. Lawrence Island polynyas, along the ice edge, or in the ice front; Divoky, 1991) would not occur. However, similar impacts are expected for those seabirds that winter in or migrate through the northern Hope Basin. The magnitude of this shift remains speculative, because it is likely that some of the same individuals (perhaps up to 50%) may pass through the Hope Basin area during migration. In addition, substantial numbers (thousands) of seabirds overwinter in the Hope Basin area. It is an important feeding area, and large numbers of seabirds (hundreds of thousands) traverse this area during spring and fall migration periods.

Helicopter and vessel traffic is expected to disturb only small numbers of individuals (perhaps hundreds) for short intervals and not cause long-term alteration of distribution or migration or result in other than negligible mortality. Impact of an oil spill in Hope Basin, however, is expected to cause substantial mortality ranging from thousands of individuals if contact is in winter, to tens of thousands if contact is during the breeding period or migration. Such losses, perhaps equalling 10 percent of local colony populations, are expected to require several generations (2-4 years each) for recovery to the original population status.

CONCLUSION: Shifting of potential oil spill and disturbance effects from Navarin Basin to Hope Basin is expected to result in a similar level of impact for regional seabird populations as described for Alternative I. Thus, overall impacts resulting from the comprehensive program Alternative VIII are expected to be approximately the same as Alternative I, requiring up to several generations (perhaps 9 years) for recovery to the original population status from oil spill and disturbance effects. Less than 10 percent of the regional seabird population is expected to be adversely affected by this alternative.

2) Shorebirds

Disturbances to shorebirds may arise from those activities that can occur in close proximity to the shoreline, mainly air traffic, pipeline construction, and onshore support-facility construction and operations. Other activities (geophysical surveys, platform construction, platform discharges, and platform removal) are not expected to have an effect on shorebirds. The level of these other activities under this alternative is not expected to differ significantly from those discussed for Alternative I in either the Pacific or Alaska OCS Regions.

As in Alternative I, routine activities in the Pacific OCS Region are expected to result in only temporary (i.e., a few weeks) disruptions in the foraging or resting behavior of shorebirds within the immediate vicinity (i.e., within 0.5 km) of helicopter flight paths. Air traffic in the Alaska OCS Region is expected to cause disruptions in reproduction of local (i.e., within 0.5 km of flight paths) shorebird populations, with recovery expected within 1 year. Within the Alaska OCS Region, the construction of pipeline landfalls and onshore facilities is expected to be at the same level of activity as Alternative I. Pipeline landfalls are expected to cause the displacement of shorebirds from the area immediately adjacent to the construction (within a few hundred meters) for about 6-8 weeks. Construction of onshore facilities could result in displacement of shorebirds within about 0.5 km of construction and the loss of about 10-15 hectares of habitat from each planning area. A temporary (i.e., less than 1 year) reduction in local productivity may result if nesting habitat were lost to construction. Because of the widespread distribution of most shorebird species in Alaska and the very small amount of habitat potentially affected, however, construction activities are not expected to cause a long-term (i.e. 1 year), measurable impact to shorebird populations. Existing legislative constraints and permitting procedures would serve to further minimize these localized effects.

The oil spill assumptions for the Pacific Region, including Alaskan tanker oil spills, do not change from Alternative I under this alternative, and the impact of assumed oil spills on shorebirds in the Pacific OCS Region are expected to be the same as for Alternative I (loss of a few to about 500 birds from southern California and Washington, with recovery within 1 year).

The impact of most oil spills assumed for the Alaska OCS Region under Alternative VIII are, expected to be similar to those as discussed for Alternative I. However, a few areas along the Alaskan coast stand out as being of particular importance to shorebirds, including the North Slope along the shores of the Arctic Ocean (an important shorebird breeding and staging area), the Yukon-Kuskokwim River Delta, and the Seward Peninsula-Copper River Delta region. Because of the higher shorebird densities found in these areas, the effect of a spill contacting one of them could be greater than with spills in other areas.

If a pipeline or platform spill were to contact the North Slope shoreline from May through September, from a few hundred to a few thousand shorebirds could be affected. If a tanker spill occurred in the Norton Basin Planning Area were to contact the northern Delta, a few thousand shorebirds could be affected, with recovery occurring in 1-3 years.

The Seward Peninsula-Copper River Delta region would most likely be affected by a tanker spill assumed to occur in the Gulf of Alaska Planning Area from proposed development in the Chukchi Sea Planning Area and by a tanker spill assumed to occur from proposed development in the Gulf of Alaska Planning Area. If a tanker spill were to contact the Seward Peninsula coastline or the Copper River Delta from May through September, a few hundred to a few thousand shorebirds could be affected, with recovery occurring in 1-2 years.

Oil spills assumed for other Alaska OCS Region planning areas are either not expected to contact shore (30,000 bbl tanker spill in the Hope Basin and St. George Basin Planning Areas) or are expected to affect no more than a few hundred shorebirds with recovery occurring in less than 1 year.

CONCLUSION: Under Alternative VIII, impacts on shorebirds from routine OCS-related activities assumed for the Pacific OCS Region are expected to be limited to temporary (i.e., a few weeks) disruptions in the foraging or resting behavior of those shorebirds in the immediate vicinity (i.e., within 0.5 km) of helicopter flight paths. Impacts from air traffic in the Alaska OCS Region are expected to include disturbance of local (i.e., within 0.5 km of flight paths) shorebird populations with some local reductions in productivity, and recovery occurring within 1 year. Construction activities assumed for the Alaska OCS Region are not expected to cause a measurable impact to shorebird populations, although a temporary (i.e., <1 year) reduction in productivity within 0.5 km of construction is expected.

The principle impacting agent from Alternative VIII in both the Pacific and Alaska OCS Regions is oil from accidental spills. Assuming oil contact with the shoreline, injury and mortality of shorebirds are expected to occur, involving a few to as many as 500 individuals, with recovery occurring in 1 to 2 years. Within the Alaska OCS Region the impact of assumed oil spills on shorebirds is expected to range from less than 100 to a few thousand fatalities, with recovery in 1-3 years. There is a 18 to 57 percent probability of one or more spills of 10,000 bbl or greater occurring over the 30-year life of the alternative in the Alaska Region. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

f. Impacts on Fish Resources

(1) Alaska Region

(a) Pacific Salmon (Alaska Population)

Routine activities and accidental events are assumed to occur at approximately the same levels in the Alaska Region for Alternative VIII as for Alternative I. However, a lease sale would occur in Hope Basin if alternative VIII is adopted rather than in Navarin Basin as is assumed for the Alternative I base-case analysis. The scenario for Hope Basin assumes a pipeline would be constructed to transport oil to shore. Construction of the pipeline would have no measurable effect on salmon. Oil spill impact would be similar to those described for Alternative I.

CONCLUSION: Routine activities assumed for Alternative VIII are expected to have no measurable effect on Pacific salmon. Oil spills contacting migratory salmon populations are expected to have adverse impacts on small segments of these fish. The numbers so affected would be small in proportion to the total population; any oil spill would have only a small-scale, small-area, and short-time effect. There is an 18- to 34-percent chance of one or more spills of 10,000 bbl or greater occurring throughout the pelagic range of migratory salmon over the 24 to 30-year life of the alternative.

(b) Walleye Pollock

Walleye pollock inhabit and spawn in the St. George Basin (not in Hope Basin) during spring and early summer annually. Routine OCS activity and accidental oil spills in the areas considered for lease under this alternative may result in some impact on spawning. As concluded by Alternative I analysis, potential adverse impacts would have no appreciable effect on walleye pollock due to the wide distribution of this species, their large populations, and extended annual spawning period.

CONCLUSION: The level of oil and gas exploration/development for Alternative VIII is not expected to have a measurable effect on the walleye pollock population.

(c) Arctic Cisco

Impacts expected to be experienced by the arctic cisco from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(6). Because the population is not present in Hope Basin, the analysis and resulting conclusion will remain the same as described in Alternative I.

CONCLUSION: Based on the assumptions for the Beaufort Sea in Alternative VIII, it is not anticipated to have any appreciable adverse effect on arctic cisco that migrate at some depth in the nearshore waters of the Beaufort Sea.

(d) Other Fish Resources

FINFISH: Pacific halibut, other flounders, Pacific herring, sole, and cod are located in the area consider for lease under Alternative VIII. These species perform seasonal migrations to different depths and, for the most part, inhabit extensive area within the Bering Sea. Thus, this wide distribution allows for only small numbers to be vulnerable impacts from routine activities or oil spills. The intermittent nature of oil spills and discharges and limited period of drilling discharges further limit vulnerability of fish. Offshore construction disruptions are also very short term.

CONCLUSION: The routine OCS activities and accidental oil spills assumed under Alternative VIII will have no measurable adverse effect on other fish resources, and the overall conclusion remains the same as that for Alternative I.

SHELLFISH: The area encompassed by this alternative is inhabited by red king crab, blue king crab, and tanner crab. These benthic species are found in the St. George Basin and eastern Bering Sea (only in small numbers in the Hope Basin area). Potential oil spills, drilling discharges, and offshore construction affect smaller areas and would result in no measurable effect from this alternative.

CONCLUSION: Alternative VIII is not expected to have a measurable effect on shellfish populations.

(2) Pacific Region

(a) Pacific Salmon (Pacific Population)

If Alternative VIII were selected, the routine activities and accidental events assumed for Alternative I in the Alaska and Pacific Regions would occur. All impacts on commercial fishery resources from both normal development and accidental causes will be the same in the Pacific Region as for Alternative I. Impacts to Pacific salmon populations within southern California from normal OCS activities associated with Alternative I would be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernable change of population levels. The pipeline oil spill and two of the three tanker oil spills are expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon. The tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of salmons in the stream affecting the impacted year class for two to four years. However, regional impacts would not be discernible from natural variations of populations within the area.

CONCLUSION: Adoption of Alternative VIII is expected to result in some lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore salmon. The tanker oil spill entering a spawning stream in Washington would cause mortalities to hundreds of salmon in the stream affecting the impacted year class for two to four years. However, regional impacts are not expected to be discernible from natural variations of populations within the area. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Steelhead Trout

Impacts to steelhead trout populations within southern California from normal activities will involve changes in the distribution of some migrating populations for a period of minutes to hours with no discernable change of population levels. Oil spills from a pipeline or tankers are expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore steelhead trout. A tanker oil spill contacting the entrance of a steelhead spawning stream in Washington or southern California (San Luis Obispo County), could result in a 10- to 20-percent reduction of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regional impacts would be less, since not every stream would be affected. Overall, mortality in the affected streams would not be discernible from natural variations of steelhead trout populations within the planning area.

CONCLUSION: Adoption of Alternative VIII is expected to result in lethal or sublethal effects that would not be discernible from natural variations of pelagic offshore steelhead trout. A tanker oil spill contacting the entrance of a steelhead spawning stream in Washington or southern California (San Luis Obispo County), could result in a 10- to 20-percent reduction of the outmigrating population, with effects to the impacted year class lasting 2-4 years. Regionally, impacts to the steelhead population would not be discernible from natural variations of steelhead trout populations within the planning area.

(c) Pacific Whiting

Impacts to Pacific whiting populations within southern California from normal activities associated with Alternative VIII are expected to be minor, involving changes in the distribution of some fish for a period of minutes to hours with no discernible change of population levels. The pipeline oil spill or two of the three tanker oil spills assumed for the alternative are expected to result in lethal or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

CONCLUSION: Adoption of Alternative VIII is expected to result in some lethal (less than 10%) or sublethal effects that would not be discernible from natural variations of whiting populations both locally and regionally.

(d) Other Fish Resources

All impacts on other fish resources from both normal development and accidental causes assumed for Alternative VIII are expected to be the same in the Pacific Region as for Alternative I discussed in Section IV.D.1.a(6). Routine activities associated with the alternative (installation and operation of manmade structures, effluents and discharges from drilling operations, underwater noise from geophysical surveys) could result in reductions of some local fish populations, but with no lasting effects on trophically dependent species. Recovery of affected local populations would occur within 2 years. Assumed oil spills are expected to result in lethal or sublethal effects locally in the area of contact. Recovery of affected local populations would occur within 2 years. A tanker oil spill entering a spawning stream in Washington could cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for two to four years. Regionally, lethal or sublethal effects would not be discernible from natural variations of fish populations within the area.

CONCLUSION: Adoption of Alternative VIII is expected to result in reductions of some local fish populations, but with no lasting effects on trophically dependent species from routine activities. Recovery of affected local populations would occur within 2 years. Oil spills would result in lethal or sublethal effects locally in the area of contact. Recovery of affected local populations would occur within 2 years. A tanker oil spill assumed to enter a spawning stream in Washington is expected to cause mortalities to hundreds of individuals of anadromous species (primarily salmon) in the stream affecting the impacted year class for two to four years. Regionally, lethal or sublethal effects would not be discernible from natural variations of fish populations within the area.

g. Reptiles

PACIFIC REGION: Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to sea turtles would remain the same. Section IV.D.1.a(7) provides a discussion of potential impacts on sea turtles and an analysis of the impacts expected as a result of Alternative I.

Routine activities that could have impacts on sea turtles include seismic surveys, the construction of subsea pipelines and platforms, air and vessel traffic, the drilling of exploratory and production wells, and drill rig and platform removal. These activities are not expected to impact sea turtle populations. The low sea turtle densities in the areas assumed to be affected (particularly north of Point Conception) make it unlikely that these animals would be affected by accidental oil spills; if mortality does occur, it is not expected to be distinguishable from natural variability within the species' populations.

CONCLUSION: Adoption of Alternative VIII is expected to have no discernible effect on sea turtle abundance or distribution.

h. Impacts on Coastal Habitats

(1) Alaska Region

WETLANDS AND ESTUARIES: The effects of oil and gas activities on wetlands and estuaries from leasing in the St. George and Hope Basins are discussed under Alternative I, (see Section IV.D.1.a(8) and Appendix F, respectively). Important wetland and estuarine habitats in the Bering Sea are far removed from the St. George Basin Planning Area. The assumed tanker spill in this planning area (37% probability of one or more spills of 1,000 bbl or greater occurring) is expected to occur near or within Unimak Pass or offshore of the mainland and not contact important wetland and estuarine habitats along the Bering Sea coast. Oil that might reach wetland and estuarine habitats would be highly weathered and dispersed and have no long-term effects on wetlands and estuaries.

Leasing in Hope Basin is assumed to result in one tanker spill (47% probability of one or more spills of 1,000 bbl or greater occurring). This spill is assumed to occur in the Bering Strait area and contaminate lagoon estuaries and adjacent saltmarsh wetlands (perhaps 50-100 km) with effects on invertebrate communities persisting for more than 10 years, the same level of effects described on wetland habitats contaminated along the Beaufort and Chukchi Sea coasts under Alternative I.

CONCLUSION: In Alternative VIII, the primary effects on wetland-estuarine habitats in the Alaska Region are expected to come from a causeway, pipeline-landfall construction, and oil spills. Hydrological effects from the causeway (changes in the physical integrity of perhaps 5 percent of the habitat) and some effects (perhaps 5-10%) on the distribution of species (anadromous fish) are expected to last for more than 10 years. Turbidity effects from pipeline burial on wetland-estuarine habitats are expected to be short term, lasting less than 2 years. Oil-spill contamination of (perhaps 50-100 km) wetland-estuarine habitats is expected to have local adverse effects on the biological diversity and productivity of invertebrate communities lasting for more than 10 years.

(2) Pacific Region

WETLANDS AND ESTUARIES: If Alternative VIII were selected no impacts from normal activities are expected. Impacts of an oil spill assumed to enter an estuary and remaining for several tidal cycles, are expected to include destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require at least 5 years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no real interference with ecological relationships in the region. No impacts to estuaries were expected in northern California, because the tanker spill is assumed to occur approximately 50 miles offshore and is not expected to contact nearshore areas.

CONCLUSION: Under Alternative VIII, impacts of an assumed oil spill entering an estuary and remaining for several tidal cycles are expected to include destruction of a major part of the local community, either of the entire estuary or those portions where oil has soaked into the sediments. Recovery could require 5 or more years. Regional impacts could involve a decrease of several populations in local estuarine communities, but with no real regional interference with ecological relationships. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative.

i. Impacts on Seafloor Habitats

(1) Alaska Region

General and specific impacts expected to be experienced by the Boulder Patch from routine activities and accidental events potentially occurring with Alternative I are analyzed in Section IV.D.1.a(9). Because this resource does not exist in the deferral area, the analysis and resulting conclusion will remain the same as described in Alternative I.

CONCLUSION: Under Alternative VIII, oil spill effects on the productivity and diversity (perhaps 10 %) of the Boulder Patch benthic organisms are expected to persist for 2 years. Turbidity and sedimentation effects on the growth and productivity of benthic organisms (perhaps 1-2%) of the Boulder Patch from pipeline burial and causeway construction are expected to persist for about 2 years.

(2) Pacific Region

(a) Intertidal Benthos

Under Alternative VIII impacts from normal activities are not expected. A pipeline oil spill and two of the three hypothesized tanker oil spills (one in Washington and one in southern California) are expected to result in smothering and immobilization to portions of local sandy beach populations of several species in the area contacted by the spill. Recovery of these populations is expected to occur within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community contacted by the spill. Recovery could be retarded in some species for a year. Some assemblages within the community could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis. The spill in northern California is assumed to occur more than 50 miles offshore and is not expected to come ashore.

CONCLUSION: If Alternative VIII is adopted, impacts from oil spills are expected to include smothering and immobilization to portions of local sandy beach populations of several species in the area contacted by the spill. Recovery is expected to occur within a year. Oil spill impacts on rocky intertidal areas in northern Washington and southern California will involve noticeable mortality and alteration of ecological relationships within the rocky intertidal community contacted by the spill. Recovery of some local populations could require 6 to 10 years to return to pre-spill conditions. Regionally, the loss or disruption of a few assemblages or communities at local areas within the region will not cause interference with ecological relationships on a regional basis. There is a

14 percent probability of one or more spills of 10,000 bbl or more occurring as a result of production in southern California over the 35-year life of the alternative. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Subtidal Benthos

Under Alternative VIII impacts from exploration and development activities on the subtidal benthos from routine operations are not expected to measurably impact subtidal organisms in the Pacific OCS Region. However, local impacts could be particularly manifest if platforms or pipelines occurred on or within 100 m (330 ft) of hard bottom features.

An oil spill is expected to result in the loss or functional disruption of a few assemblages or communities at local areas within the region. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of thousands of individuals on the hard bottom community contacted causing alterations of ecological relationships. Recovery could require at least two years.

CONCLUSION: Adoption of Alternative VIII is expected to result in the loss or functional disruption of a few assemblages or communities at local areas within the Pacific Region. A spill contacting one or more of the relatively few hard bottom communities could result in noticeable mortality of the hard bottom community contacted causing alterations of ecological relationships lasting for at least two years. Functionally, oil contact with a few hard bottom communities would not cause interference with regional ecological relationships or population levels. There is a 14 percent probability of one or more spills of 10,000 bbl or more occurring as a result of production in southern California over the 35-year life of the alternative. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

j. Impacts on Coastal Communities

(1) Alaska Region

(a) Demography and Employment

The scenario assumptions in the Alaska Region for Alternative VIII are almost the same as Alternative I except that leasing and related activities would occur in Hope Basin rather than Navarin Basin.

Oil spills could occur in any one of the planning areas. As for Alternative I, it is assumed that most employment associated with oil-spill cleanup would be in locations separated from regional centers, but the actual hiring and population increase would occur in the regional centers.

Impacts on demography and employment that would result from the routine activities of Alternative VIII would be concentrated in regional centers. Because Kotzebue is the regional center for Hope Basin, local employment generated by OCS activity is expected to be more than 5 percent but not more than 10 percent of projected employment for 2 to 5 years, and no sector of the local labor force is expected to change by more than 10 percent. Because Unalaska, Dutch Harbor, St. Paul, and St. George are regional centers for St. George Basin, the effect would spread to each of the centers. The increase is expected to be 5 to 10 percent for 2 to 5 years, and no sector of the labor force would change more than 10 percent.

Population increases are expected to be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole would be between 1 and 5 percent for less than 2 years, with no change in any sector of the State labor force greater than 10 percent. The principal cause of this impact is that employment and population directly in OCS-related activity generate secondary employment on a routine basis.

An oil spill would generate up to 15 jobs in the closest regional center for up to 1 month if an oil spill occurred in one of the planning areas. The size of the population increase is expected to be the same as the employment increase, because it is assumed no families would accompany these workers for such a short period of time.

CONCLUSION: The impacts of Alternative VIII on demography and employment are the same as Alternative I. For the regional centers, local employment is expected to be more than 5 percent but not more than 10 percent of projected employment for 2 to 5 years, and no one sector of the local labor force is expected to change by more than 10 percent. Population increases are expected to be in the same range as the employment increases for all the local areas. Employment and population increase for the State as a whole is expected to be between 1 and 5 percent for less than 2 years, with no change in any sector of the State labor force greater than 10 percent. An oil spill would generate up to 15 jobs in the closest regional center for up to 1 month.

(b) Land Use

The resources forecast for the St. George Basin Planning Area in this alternative would not change from those forecast for Alternative I. Infrastructure, and hence land use requirements for this alternative regarding St. George and St. Paul Islands, would remain the same as Alternative I. The primary difference between Alternative I and this alternative is the addition and analysis of the Hope Basin Planning Area. Infrastructure and land use requirements would be few and generally associated with the establishment of an air-logistic base and a marine-support-service base.

CONCLUSION: The impacts of this alternative would be significantly less (more than 50%) than that of Alternative I. Description of land use patterns would occur in less than .025 percent of Alaska lands. Regional land use patterns could still be affected by pipeline and pipeline-service road construction.

(c) Transportation Networks

The level of exploration, development, and production activity assumed for Hope Basin is similar to the level of activity assumed for Navarin Basin in the Alternative I base-case analysis. Therefore, vessel and air traffic for Alternative VIII is expected to be the same as for Alternative I.

CONCLUSION: The effects of Alternative VIII are expected to be same as for Alternative I. Vessel and air traffic in Alaska are not expected to increase to the point at which the transportation systems are stressed.

(d) Sociocultural Systems

The primary structural difference between Alternative I (Alternative I) and this alternative is the substitution of the lease sale in the Hope Basin for the lease sale in the Navarin Basin. Because this Bering/Arctic alternative includes leasing in both the St. George and Hope Basins, and leasing in the St. George Basin was considered under Alternative I, the analysis of effects described in Section IV.D.1.a(10) for Alternative I on sociocultural systems as a result of a lease sale in the St. George Basin is incorporated by reference.

The characteristics of the environment upon which to assess effects on sociocultural systems are the same as for Alternative I, with the exception of adding the characteristics of the Northwest Arctic Borough. The impact producing agents (IPA's) also are the same as for Alternative I, including the introduction of changes in industrial activities, changes in local population and employment, and effects on subsistence harvests.

As in Alternative I, the changes in industrial activities introduced by these IPA's would be community-specific and, in most cases, would not represent the introduction of industrial activities for the first time. Most supply and support bases would be located at or near existing industrial infrastructure such as airports and harbors. Industrial enclaves are assumed to be used in areas without existing industrial infrastructure.

Changes in the number and characteristics of population and employment associated with industrial growth in the Hope Basin likewise would be community-specific and likely would be centered in Kotzebue and indirectly affect other communities of the NAB. Minor increases in population and employment should be absorbed in Kotzebue without seriously disrupting existing institutions or values, although the community may be stressed by the introduction of oil-related people. Elsewhere in Alaska, the effects of additional population and employment in this alternative on sociocultural systems would be the same as Alternative I, because the given conditions of future OCS activities elsewhere in Alaska are the same as Alternative I.

Impacts on subsistence are probably the most powerful means for effecting existing social systems in Alaska and causing impacts on sociocultural systems within specific and regional (such as the NAB Inupiat) communities. As shown in the analysis of impacts on subsistence for this alternative, the relatively high probability (27%) of an oil spill of equal to or greater than 10,000 bbl occurring from a tanker incident suggests that impacts on subsistence would be realized, producing the possibility that one or more important subsistence resource would become unavailable, undesirable for use, or available only in greatly reduced numbers for 1 to 2 years during the 24- to 30-year life of the proposed leases in the Hope Basin. The variables of an oil spill are such as to make prediction of specific effects on specific subsistence resources difficult, but it is likely there could be effects to more than one important resource as well as impacts to hunters and fishermen in not knowing whether their catches are safe to eat.

The loss or perceived loss of any important subsistence resources would seriously affect the relative balance of subsistence practices not only in terms of quantities of protein used during the annual harvest cycle but also the balance of social and political relationships. Disruptions of Inupiat subsistence harvests would disrupt subsistence-task groups, crew structures, and sharing networks among kinship groups and within and among communities.

Substitution of other resources for lost or contaminated fish or wildlife resources would be possible if such resources were available at the time and in the quantity needed. A noticeable increase in social stress would be expected in the communities effected, producing a sense of loss and dislocation, expressed in rising rates of substance abuse, violence, suicide, accidental deaths, mental illness, and other social problems. The growth of such problems is indicative of negative sociocultural effects, and the stress and anxiety caused by the disruptions may last for a longer period of time than the subsistence loss itself.

Elsewhere in Alaska, the potential IPA's relative to this alternative are the same as Alternative I, as the alternative contains no changes beyond the number of sales. This would produce the same effects on sociocultural systems outside the Arctic as Alternative I.

The effects of added measures of protection would be the same as for Alternative I.

CONCLUSION: Impacts on sociocultural systems in Alternative VIII are expected to be the same as Alternative I in all areas of Alaska except the area impacted by the Hope Basin lease sale. A tanker oil spill of equal to or greater than 10,000 bbl occurring and impacting subsistence in the NAB for 1 to 2 years during the 24- to 30-year life of the proposed leases in the Hope Basin is expected to impact sociocultural systems during at least this period of time and likely for an unknown period of time beyond. A measurable increase in social stress would be expected in the communities affected, resulting from the need to cope with a resource substitution problem and producing a sense of loss, mourning, and dislocation.

Elsewhere in Alaska, the potential IPA's relative to this alternative are the same as Alternative I, as the alternative contains no changes beyond the number of sales. This would produce the same effects on sociocultural systems outside the Arctic as Alternative I.

(2) Pacific Region

(a) Demography and Employment

Impacts to employment and population in Alternative VIII are expected to be identical to those identified for Alternative I.

It is assumed that if one or more oil spills occurred and contacted the coast, it would involve some employment opportunities in cleanup operations. Employment from oil spill cleanup activities due to this alternative is approximately equivalent to 400 person-years of employment. But it is expected that employment would be temporary and would not involve any population increase.

CONCLUSION: The expected impacts to employment and population under Alternative VIII are the same as under Alternative I (less than one percent of the general growth).

(b) Land Use

Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Therefore, expected impacts to land use in Alternative VIII are identical to those identified for Alternative I.

Under Alternative VIII, no changes to land use are expected since no new onshore facilities are assumed to be constructed. But housing needs for the new resident population could result in the conversion of about 230 acres of open space land for residential use.

CONCLUSION: If Alternative VIII is adopted, no changes to land use are expected. However, as in Alternative I, the housing needs of the estimated 2,300 new residents could result in the conversion of about 230 acres of open space land for residential use. Impacts to land use as a result are expected to be less than one percent.

(c) Vessel Traffic and Ports

As a result of Alternative VIII, there could be an increase in the number of crew and supply boats operating in southern California. It is assumed that during the exploration and development phase there will be two supply boat trips per week and two crew boat trips per day for each platform or rig. During the production phase, this will be reduced to one supply boat trip per week and two crew boat trips per day per platform. When these vessels use or traverse traffic lanes which cross the proposed leasing area, potential conflicts could occur. These conflicts include collisions and vessel rerouting. Conflicts could also arise when vessels do not adhere to designated traffic lanes. At this time, no temporary or permanent structures exist in the traffic lanes, precautionary areas or safety fairways.

Temporary impacts of up to two months to marine vessels, such as rerouting and/or preclusion from leaving port are expected as a result of the hypothesized oil spills, which included a pipeline spill in southern California, tanker spills off the coast of Washington, northern California, and southern California. This risk off northern California would be reduced slightly since it was assumed to occur approximately 50 miles offshore and not expected to reach shore.

CONCLUSION: Impacts due to Alternative VIII are expected to remain the same as Alternative I. Due to an assumed oil spill, some impacts are expected to large marine vessels and local commercial fishing vessels. Ship traffic may be rerouted around the spill for the duration of the at-sea-cleanup activities (which could last from 30 to 60 days). There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(d) Public Services

As a consequence of Alternative VIII, all activities and accidental events that are part of Alternative I would still occur. Therefore, impacts to the water supply are identical to those identified for Alternative I.

The activities associated with the Alternative VIII scenario are expected to result in an increase in water demand of about 10 million gallons of potable water in the peak year 2007 and about 47 million gallons of non-potable water.

CONCLUSION: The Alternative VIII is expected to result in an increase in water demand of about 10 million gallons of potable water in the peak year 2007 and about 47 million gallons of non-potable water. This increase in demand would put more pressure on already limited existing water supplies in the southern California area.

k. Impacts on Fisheries

(1) Alaska Region

COMMERCIAL FISHING: The routine elements of the scenario that may affect commercial fishing are as follows: OCS-vessel traffic that could conflict with commercial-fishing traffic, especially in areas such as enclosed bays; wells, platforms, and offshore pipelines; and onshore marine bases that are also used by the commercial-fishing industry. The number of wells and platforms in the Alaska Region for Alternative VIII are the same or nearly the same as Alternative I.

Potential adverse effects on the commercial-fishing industry include: (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; (3) loss or damage to fishing vessels through collisions with oil-industry vessels; (4) competition for support services, infrastructure, materials, and labor; and (5) competition for space onshore.

Oil spills could damage the commercial fisheries by gear fouling; preemption or closure of fishing areas; direct loss of catch; and contamination or tainting of harvest. The number of spills are the same for Alternative VIII as for Alternative I. However, one tanker spill is assumed to occur in Hope Basin for Alternative VIII rather than in Navarin Basin as is assumed for the Alternative I base-case analysis. Impacts on water quality from oil spills, which are analyzed in the water-quality section, are used in analyzing impacts on commercial fish. The conclusion of that section is that water quality on up to several thousand square kilometers could be reduced by hydrocarbon contamination for about 30 days.

For each of the planning areas with commercial fishing, it is expected the impact of Alternative VIII on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear up to 5 percent and loss of secondary employment up to 5 percent resulting from (1) elimination or foreclosure of fishing area by the presence of exploration rigs, production platforms, subsea completions, and pipelines, resulting in a possible loss of harvest; (2) gear conflicts, resulting in loss or damage to fishing gear, harvest loss, and lost fishing time; and/or (3) loss or damage to fishing vessels through collisions with oil-industry vessels. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor as a result of increased competition. Costs to commercial fishermen are expected to increase no more than 10 percent for space onshore as a result of increased competition. These impacts are expected to last for as many seasons as there is OCS activity.

CONCLUSION: The impacts on commercial fishing from Alternative VIII are the same as for Alternative I. For each of the planning areas with commercial fishing, it is expected the impact on commercial fishing is loss of catch and direct employment and damage or loss of fishing gear up to 5 percent and loss of secondary employment up to 5 percent. Costs to commercial fishermen are expected to increase up to 5 percent for support services, infrastructure, materials, and labor and no more than 10 percent for space onshore. These impacts are expected to last for as many seasons as there is OCS activity.

As a result of an assumed oil spill, commercial fishing is expected to be affected for about 30 days for an area as large as several thousand square kilometers. For about 30 days, the commercial fisheries are expected to have up to 5 percent loss of catch and up to 5 percent loss of direct employment and indirect employment; damage or loss of fishing gear fouled by oil could be up to 5 percent. There is an up-to-81-percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the western coast of the U.S. over the 25-year life of the alternative.

(2) Pacific Region

(a) Commercial Fishing

Under Alternative VIII, impacts to commercial fisheries from routine activities (installation and operation of offshore manmade structures, vessel traffic, effluents and discharges) and small oil spills are expected to involve inconveniences lasting for the 35-year life of the platform with little or no discernible economic loss. Oil spills from a pipeline or tankers contacting fixed gear fishing sites could result in economic losses ranging from 20 to 30 percent lasting for two seasons, with more than 10 percent unemployment among fixed-gear fishermen. Financial losses to economically dependent businesses in nearby communities could range up to 20 percent.

CONCLUSION: Adoption of Alternative VIII is expected to result in economic losses ranging up to 30 percent for affected fixed-gear fishermen. Financial losses to economically dependent businesses in nearby communities could range up to 20 percent. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

(b) Recreational Fishing

If Alternative VIII were selected, routine activities (installation and operation of manmade offshore structures, increased vessel traffic, and drilling discharges) are expected to result in economically indiscernible minor inconveniences to marine recreational fishing activities. While numerous, small oil spills are assumed to occur, they are unlikely to have any impact on recreational fishing. The assumed oil spills contacting a harbor used by sport fishermen are expected to result in local economic losses of 10 to 20 percent over a period of approximately a month, or the length of time needed for spilled oil to be cleaned up or dissipated by wind and waves. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced by the alternative, fisheries resources available to sportfishermen will be unchanged.

CONCLUSION: Adoption of Alternative VIII is expected to result in local economic losses of 10 to 20 percent over a period of approximately a month. No discernible area-wide impacts are anticipated due to the number of harbors that would not be affected by a spill. Since local and regional fish populations are not expected to be reduced, fisheries resources available to sportfishermen will be unchanged. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to a 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

l. Impacts on Subsistence

(1) Alaska Region

The substitution of a lease sale in the Hope Basin for the Navarin Basin is the primary structural difference between Alternative I and this alternative. Because this alternative includes leasing in both the St. George and Hope Basins, and leasing in the St. George Basin was considered under

Alternative I, the analysis of effects in Alternative I on subsistence as a result of a St. George sale is incorporated by reference.

The characteristics of the environment upon which to assess effects on subsistence are the same as for Alternative I, with the exception of adding the characteristics of the Northwest Arctic Borough (NAB). The IPA's also are the same as for Alternative I, including oil spills, noise and traffic disturbance, or disturbance from construction activities associated with pipelines and shore-base facilities.

Facilities associated with this alternative (beyond those considered under Alternative I) include one additional shore-base- support facility, a 90 mile oil pipeline, and pipeline landfall.

The effects on subsistence from constructing these facilities should be localized and of relatively short duration, perhaps similar to the effects on subsistence from construction of the shore terminal for the Red Dog mine in the NAB. Such facilities would eliminate a portion of marine and terrestrial habitat, supportive of fish and wildlife resources, but it is unlikely that such a small loss would measurably change subsistence harvests of such resources. Effects on subsistence from the construction of facilities elsewhere in Alaska are the same as Alternative I.

Operations in the Hope Basin would extend over 25 years, from 1996 to 2021, and include drilling 8 exploration/delineation wells and 34 development/production wells. Effects on subsistence from such drilling operations could arise if noise and traffic disturbance associated with travel between the offshore platform and the onshore support and supply base were to reduce availability of marine resources (primarily marine mammals) through their avoidance of such disturbance. A similar reduction in the availability of subsistence resources could arise around the support and supply base on shore. However, the magnitude of such conditions in both cases should be minimal and of relatively short duration if they were to occur.

Oil produced from the Hope Basin would be transported from the platform by pipeline to an onshore storage facility and then tankered to west coast ports during the open-water season; natural gas is not considered a marketable resource of the area. One tanker oil spill is assumed over the life of the project, with a 47-percent probability of one or more spills of 1,000 bbl or greater and a 27-percent probability of one or more spills of 10,000 bbl or greater. Although the potential lease-sale area is limited to the northern reaches of the Hope Basin Planning Area (see Figure II.A.1-3), a tanker spill could occur anywhere south of a potential onshore oil-storage-facility site. Impacts on subsistence from such a tanker spill would be considerable if the spill occurred nearshore and at a time when primary subsistence resources were present. Assuming the open-water season to extend approximately from early June to mid-November (depending on ice conditions), bowhead whales and walruses already should have passed through the area during their spring northern migration and would not be present during the open water-period. Other marine mammals would be present, along with fishes and seabirds. Land animals, especially caribou and bear, could be impacted by coastal oiling and the oiling of prey species. Birds are especially vulnerable to oiling as they forage for food offshore, whereas adult fishes may be able to avoid contact with spill conditions. The variables of an oil spill are such as to make prediction of specific effects on specific subsistence resources difficult, but it is likely there could be effects to more than one important resource as well as impacts to hunters and fishermen in not knowing whether their catches are safe to eat. The loss or perceived loss of any important subsistence resources would seriously affect the relative balance of subsistence practices not only in terms of quantities of protein used during the annual harvest cycle but also the balance of social and political relationships. The high probability of occurrence of a spill suggests that one or more important subsistence resource would become unavailable, undesirable for use, or available only in greatly reduced numbers for 1 to 2 years during the life of the proposed leases in the Hope Basin. Substitution of other resources for lost or contaminated fish or wildlife resources would be possible if such resources were available at the time and in the quantity needed.

Elsewhere, the potential IPA's relative to this alternative are the same as Alternative I because the alternative contains no changes beyond the addition of a Hope Basin sale. This would produce the same effects on subsistence elsewhere as Alternative I.

The effects of added measures of protection are the same as for Alternative I.

CONCLUSION: Impacts on subsistence in this alternative are expected to be the same as Alternative I in all areas of Alaska except the area impacted by the Hope Basin lease sale. An oil spill of equal to or greater than 10,000 bbl occurring from a tanker incident is expected to impact subsistence, producing the possibility that one or more important subsistence resource would become unavailable, undesirable for use, or available only in greatly reduced numbers for 1 to 2 years during the 24- to 30-year life of the proposed leases in the Hope Basin.

(2) Pacific Region

Routine activities associated with Alternative VIII in the Pacific Region, including the construction of subsea pipelines and platforms, the drilling of exploratory and production wells, and drill rig and platform removal, are expected to occur at least 3 miles offshore, away from intertidal gathering areas. No impacts to intertidal gathering areas are expected.

Three oil spills of 1,000 bbl or greater are assumed to occur in the Pacific Region and to contact the shoreline under this alternative; one off the coast of Washington, and two off southern California. Impacts to subsistence resources from accidental pipeline spills or spills of Alaskan oil transported by tankers greater would depend upon the location and season. The greatest effects to subsistence could be expected if the spill contacted rocky intertidal areas near population centers. This could have the effect of reducing the availability or desirability of one or more important species in some local areas on the coast for up to a year.

CONCLUSION: Adoption of Alternative VIII is expected to result in temporary effects on subsistence in the Pacific Region due to accidental oil spills. No impacts to onshore and intertidal gathering areas from routine exploratory and development activities associated with this alternative are expected. Assuming occurrence and contact, an oil spill that contacts an intertidal subsistence area is expected to result in a reduction in the availability or desirability of one or more subsistence resources for up to a year. There is a 14 percent probability of one or more spills of 10,000 bbl or greater occurring as a result of production in southern California over the 35-year life of the alternative. There is up to 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

m. Impacts on Archaeological Resources

(1) Alaska Region

In this alternative, Hope Basin would be substituted for the Navarin Basin analyzed under Alternative I. The level of OCS activity would remain the same.

It is assumed in this alternative that there will be approximately 90 exploration and development wells and 500 development and production wells over the entire Alaskan OCS. These activities could result in impacts to archaeological resources.

Alternative VIII would not change routine activities potentially affecting archaeological resources. As a result, the analysis and conclusion described under Alternative I (Section IV.D.1.a) would not change for Alternative VIII.

CONCLUSION: Under Alternative VIII, it is expected that some impact may occur to coastal historic and prehistoric resources from accidental oil spills.

(2) Pacific Region

Archaeological resources could be affected as a result of bottom disturbing activities, such as exploratory drilling, installation of platforms, or installation of offshore pipelines. However, prior to the initiation of drilling operations, locating platforms, or pipeline operations, remote sensing surveys are conducted at prospective well and platform sites, and along pipeline corridors. The results of these surveys are used to identify and avoid any anomalies that may represent archaeological resources. Any site that is discovered during operations will be reported, and the operator will be required to follow directions from MMS to protect the resource.

No new onshore facilities or new pipeline landfalls were expected for Alternative VIII. Existing facilities may have to be modified to accommodate additional OCS production, but all modifications will occur within the boundaries of current facilities. Consequently, no impacts to archaeological resources are expected from onshore facility construction.

The seven platforms assumed for alternative VIII are not expected to cause a change in the surroundings of any site such that its National Register eligibility would be affected. Therefore, no impact to onshore archaeological resources is anticipated in the sale area from the intrusion of platforms into the viewshed of the archaeological resources in the area.

Impacts to archaeological resources from accidental pipeline spills or spills of Alaska oil transported by tankers include temporary degradation of the viewshed of any historic or prehistoric sites, and damage to potential archaeological sites during clean up operations. Degradation of a historic viewshed could negatively affect a site's National Register eligibility. The duration this impact depends on the size of the spill, the oil retention of the particular stretch of coastline, and the amount of clean up effort. It is anticipated that spill cleanup operations will take a few weeks to one month. Once the cleanup is completed, the viewshed is expected to return to its pre-spill state.

Archaeological sites can be accidentally damaged or destroyed during cleanup operations as the crisis atmosphere of the cleanup would likely preclude a survey to identify and protect sites in the area. The level of damage would depend on the value of information lost at each affected site and the number of sites impacted.

Submerged sites are not expected to be impacted by an oil spill unless the oil sinks and settles on the bottom, coating any artifacts that may be present. The impact to any submerged sites contacted by oil will depend upon the amount of contamination, and how the artifact responds to the coating of oil. If artifacts absorb oil it could affect radiocarbon dating of the site. Overall, accidental oil spills are expected to result in a negligible loss of scientific information from archaeological resources.

CONCLUSION: Routine OCS activities associated with the Alternative VIII are expected to have negligible impacts on archaeological resources in the Pacific Region. Assuming a spill and contact with the shoreline, the viewshed of onshore prehistoric or historical sites would be temporarily degraded during the spill and associated cleanup activities. The probability of one or more pipeline spills greater than 10,000 bbl occurring off southern California is approximately 14 percent. There is up to an 81 percent probability of one or more spills of 10,000 bbl or greater from OCS tanker spills along the west coast over the 35-year life of the alternative.

n. Impacts on Recreation and Tourism

PACIFIC REGION: Under Alternative VIII, the routine activities and accidental events assumed to occur in the Pacific Region do not change from that described for Alternative I. Consequently, impacts to recreation resources in Alternative VIII are identical to those identified for Alternative I (Section IV.D.1.a(14)).

Installation of new platforms on existing leases within 16 km (10 miles) of the coast will cause a noticeable change in local scenery. Impacts on tourism are expected to be inconsequential.

Crew and supply vessels associated with existing and projected facilities are not expected to result in measurable impact to recreational boaters because these vessels will operate from existing ports and use established vessel traffic lanes.

Installation of offshore pipelines will temporarily disrupt recreational activities in the vicinity of the pipeline route for the duration of construction operations, approximately 3-4 months. No measurable impacts to the levels of tourism activities are expected in communities near pipeline installation operations.

Impacts to recreational resources from an accidental pipeline spill or spills of Alaska oil transported by tankers greater than 1,000 bbl include closure of the affected beach for approximately one month, temporary displacement of resource users to unaffected sites, financial losses to local merchants servicing the contaminated area, and temporary degradation of aesthetic qualities of the spill site. These impacts are expected to continue for the duration of clean up operations, approximately one month.

CONCLUSION: Routine operations on existing leases are not expected to affect recreation resources or tourism levels. A change of scenery quality is expected in areas where one or more platforms is installed within sight of the coast line. An accidental tanker spill of imported oil is expected to close recreation facilities at the affected site for one month. Recreation resource users will be temporarily displaced and local merchants deriving income from those users will experience an economic loss during the clean up period.

E. Unavoidable Adverse Environmental Effects

1. Impacts on Water Quality

Unavoidable adverse effects on water quality are expected as a result of the proposed action. Operational discharges of drilling muds and cuttings, formation water, and small amounts of hydrocarbons (1 bbl) into the water column during routine offshore natural gas and oil operations would lower local water quality. These discharges are expected to raise levels of some water quality parameters above normal within 100 m to 2000 m of the discharge point temporarily (up to 3 months) during drilling and intermittently/continuously during the 30-40 year production period.

2. Impacts on Air Quality

An increase in emissions of air pollutants would occur as a result of the proposed action. Emissions of nitrogen oxides (NO_x) and reactive hydrocarbons (RHC) would increase ozone concentrations in the immediate vicinity of the offshore operations for intermittent periods during the term of the proposal. In areas where offshore natural gas and oil activities occur near onshore non-attainment areas, emission offsets may be required. Offshore emissions for the proposal are expected to be less than 5 percent of the existing onshore emissions.

3. Impacts on Marine Mammals

Marine mammals would be adversely affected by noise and disturbances associated with routine offshore activities (seismic surveys, vessels, aircraft, drilling, and dredging) during the relatively brief period of time it would take them to move past these activities. Some marine mammals would exhibit, short-term responses to such noises, while others would exhibit confusion and exodus. Assuming an oil spill occurred and contacted marine mammals it is probable that some would experience minor short-term effects, while a small number of marine mammals would die. An oil spill would adversely affect local marine mammal prey resources in small areas affected by a spill.

4. Impacts on Terrestrial Mammals

Adverse disturbance of terrestrial mammals by offshore-related aircraft, vehicles, facilities, human presence, and habitat alteration from construction activities are unavoidable. Disturbance of terrestrial mammals would be temporary and would not affect their overall distribution and abundance.

5. Impacts on Marine and Coastal Birds

Marine and coastal birds would be adversely affected by noise and disturbances associated with routine offshore and onshore activities. Habitat alteration from the construction of onshore facilities would affect a small portion of the available habitat, but would cause long-term habitat loss. Assuming an oil spill occurred and contacted marine and coastal bird habitat. Some birds would experience minor short-term effects, while birds which feed in the water or rest on the water would be coated with oil and die. An oil spill could also adversely affect local marine and coastal bird prey resources.

6. Impacts on Fish Resources

Juvenile fish could be adversely affected by disturbances and turbidity associated with routine offshore and coastal activities. Wetland and estuarine habitat alteration resulting from pipeline and other related coastal construction would have an unavoidable adverse impact on fish nursery areas. Assuming an oil spill occurred and contacted fishery habitat, there would be an adverse effect on local fishery stocks and food webs.

7. Impacts on Reptiles

Some alligators and endangered and threatened sea turtles may be unavoidably displaced, injured, or killed by activities associated with the proposed action.

8. Impacts on Coastal Habitats

Some adverse effects on coastal wetlands caused by facility construction are expected to be unavoidable. Some small operational oil spills resulting from coastal construction are unavoidable. However, the effect of these spills are expected to be localized (within 100 m of the construction site).

9. Impacts on Seafloor Habitats

Adverse effects on seafloor habitats and associated organisms could occur from anchoring, drilling discharges, structure emplacement and removal, and pipeline emplacement. Assuming an oil spill occurred and contacted the seafloor, there would be an adverse effect on seafloor habitats and associated organisms within the area affected by the spill.

10. Impacts on Coastal Communities

The proposed action with it's ancillary activities will place increased demands on coastal communities. A few of these requirements may unavoidably conflict with land use plans and coastal management programs within local jurisdictions. Potential oil spills could affect commercial fishing and subsistence harvests and disrupt the economy of coastal communities.

11. Impacts on Fisheries

Commercial and to a lesser extent recreational fisheries will be adversely effected by loss of fishing area occupied by offshore vessels, platforms, and exposed pipelines. Assumed oil spills and operational discharges could contaminate, injure, or kill shellfish, finfish, eggs and larvae in the vicinity of oil spills or discharges.

12. Impacts on Subsistence

Some unavoidable adverse effects on subsistence harvests in the Alaska Region may result from routine offshore natural gas and oil activities. These offshore and onshore activities could cause localized displacement or loss of small numbers of subsistence resources. Potential oil spill effects on bowhead and beluga whales and walrus may lead to a reduction of total annual harvests of these species. Short-term loss of some subsistence resources and potential repercussions on the culturally significant sharing system are expected to be unavoidable.

13. Impacts on Archaeological Resources

Unavoidable adverse effects to archaeological resources could occur as a result of the proposed action. Construction and siting of offshore and onshore natural gas and oil facilities such as platforms, pipelines, or processing facilities could displace, damage, or destroy archaeological resources.

14. Impacts on Recreation and Tourism

Unavoidable adverse effects could occur to recreation areas and tourism from floatable debris and assumed oil spills which contact beach areas. Effects on aesthetics could also occur.

F. Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity

The short-term effects and uses of various components of man's environment are related to long-term effects and the maintenance and enhancement of long-term productivity. The effects of the proposed action would vary in kind, intensity, and duration, beginning with the preparatory activities (seismic-data collection and exploration drilling) for offshore natural gas and oil development and ending when the natural environmental balances are restored.

For the discussion in this section, short-term refers to the period of activity for the completion of the proposed action; but some even shorter-term uses and effects are considered and discussed. Long-term refers to the period of time after the completion of the proposed action. The overall life of the base case scenario for the proposed action is estimated to be about 30 to 45 years, with about 10 years of natural gas and oil exploration and delineation activity and about 25 years of resource development and production activity. Short-term refers to the total duration of natural gas and oil exploration and production, whereas long-term refers to an indefinite period beyond the termination of resource production.

Many of the effects discussed in Section IV.D. are considered to be short-term (being greatest during the exploration, development, and early production phases) and may be reduced by mitigating measures as discussed in Section IV.D.

Onshore facility construction (e.g., pipelines, processing facilities, service bases, etc.) cause definite changes in the short- and the long-term, with localized long-term effects on coastal habitats along the onshore pipeline corridor. Some species, such as nesting birds, may have difficulty repopulating altered habitats and could be permanently displaced from the local construction area. Short-term biological productivity would be reduced or lost on most onshore areas constructed for the proposed action; however, the long-term productivity of some of these areas could be mitigated with habitat reclamation.

Offshore facility construction (i.e., platforms, pipelines, man-made islands, etc.) could cause long-term changes by altering the local habitats of some benthic organisms. Short-term oil pollution and the potential for long-term accumulations of pollutants may cause adverse effects on some components of the marine ecosystem.

Biological resources would be threatened in the short-term by potential oil pollution. Displacement could be serious through the combined effects of harassment by humans and the increased volume and frequency of noise from aircraft and vessel traffic. Such disturbances could alter behavior patterns and drive wildlife from traditional breeding, feeding, and nesting areas or to other habitat areas within their ranges, thus reducing the local populations of species over a long period of time.

In the Alaska Region, habitat destruction could cause a local reduction in subsistence resources, which could threaten the regional economy and weaken the core values of sharing Native goods and subsistence as a way of life. The improved accessibility to primitive areas from increased road construction is a short-term and long-term result of the proposed action. The wilderness values of the coast and along pipeline routes and associated access roads would decrease with increased human activity in these areas. Land use changes would be noticeable at onshore facility sites and along pipeline routes. Short-term changes include a shift in land use from subsistence-based activities to industrial activities during the life of the proposed action. Areas adjacent to onshore facilities and pipeline corridors would probably be subject to hunting regulations. Land use of the area would change from conservation to resource development. This would be a short-term change if, after production ceases, land use reverts to previous uses. Long-term effects on land use may result if the infrastructure or facilities continue to be used after the lifetime of the proposed action. Potential users would be other resource developers, residents, or nonresidents who have become accustomed to the convenience of traveling the associated roads.

Increased population, minor gains in revenues, and the consequences of oil spills all contain the potential for disrupting coastal communities in the short-term. Added incentive to shift from a subsistence-based economy to a cash-based economy, a reduction in subsistence resources, a decrease in subsistence activities, and other changes brought about by the proposed action could be factors in long-term consequences for native social and cultural systems.

Archaeological and historic finds discovered during development would enhance long-term knowledge. Overall, finds may help to locate other sites; but destruction of artifacts would represent long-term losses.

Extraction and consumption of offshore natural gas and oil would be a long-term depletion of nonrenewable resources. Economic, political, and social benefits would accrue from the availability of these natural resources. Most benefits would be short-term and would decrease the Nation's dependency on oil imports. If additional supplies of natural gas and oil were discovered and developed, the emplaced production system would enhance it's extraction.

The production of offshore natural gas and oil from the proposed action would provide short-term energy and perhaps additional time for the development of long-term alternative energy sources or substitutes for these nonrenewable resources.

Local and regional planning may aid in controlling changing economics and populations and, thus, in mitigating adverse effects.

Alternatives to the proposed action such as slowing the pace of leasing, excluding additional planning areas, establishing coastal buffers, and excluding designated bathymetric features would reduce to varying degrees both the long and short-term environmental effects as well as the long and short-term energy benefits. The overall, long-term effect of the proposed action would be to reduce the productivity of the environment.

G. Irreversible and Irretrievable Commitments of Resources

1. Mineral Resources

Assuming the undiscovered, economically recoverable offshore natural gas and oil resources estimated to be leased in the proposed action were discovered (Section II.A.1.a), they would be irretrievably utilized, though it is feasible to recycle some petroleum hydrocarbon products.

2. Fauna and Flora Resources

Offshore and onshore natural gas and oil activities such as aircraft, vessel, and vehicle traffic, facility construction, platform removal, etc. could permanently displace some fauna and flora species from favorable habitats to unfavorable habitats. Displacement and habitat loss may result in the reduction of some local populations and become irretrievable if alterations to the environment were permanently maintained. However, the degree of displacement and amount of irretrievable habitat loss are expected to represent a transitory and negligible effect on the overall populations of these species.

3. Coastal Wetlands

An irreversible and irretrievable commitment of biological resources may occur where wetlands are impacted by dredging, construction activities, and oil spills. Dredging and construction activities can destroy wetland vegetation, which results in soil erosion and wetland loss.

4. Land Use Plans and Coastal Management Programs

It is unlikely that the landscape would revert exactly to its predevelopment characteristics. However, the land may revert to it's previous use.

5. Sociocultural Systems

Many important aspects of North Slope Alaskan Inupiat society and culture are centered around subsistence hunting of the bowhead whale and the sharing of its meat. In the event that noise disturbance or oil spills disrupted the harvesting of bowhead whales, there would be a loss to Inupiat social and cultural values. Such a loss may be irreversible and irretrievable, potentially resulting in social stress in the communities and a breakdown of family ties and in the communities' sense of well-being. The contribution of the proposed action to existing offshore and onshore energy development, in conjunction with other processes of social change, may in the long term lead to the irretrievable loss of the Inupiat language and other cultural behaviors.

6. Archaeological Resources

Irretrievable prehistoric archaeological sites and culture materials may be lost through looting and indiscriminate or accidental activity on known and unknown sites. Loss of ground context in which artifacts are located is a very important factor in dating and relating an artifact to other artifacts. The orientation program and the archaeological stipulations would mitigate some losses.

H. Unlikely Accidental Events

This section analyzes the potential effects of hypothetical accidents assumed to occur under unfavorable conditions in each of the four OCS Regions. Although the analysis in this section considers the impacts of a very large oil spill (100,000 bbl or greater) or a gas blowout, the likelihood of these events occurring as a result of the proposed program is extremely low.

1. Gulf of Mexico Region

a. Introduction

A spill of 100,000 bbl is assumed to occur as a result of an accident involving a shuttle tanker transporting oil produced as a result of a sale in the proposed program.

As oil and gas exploration and production extends farther offshore into deeper water, the use of shuttle tankers to bring oil to shore for processing, rather than the installation of pipelines, may become economically advantageous. This document assumes that less than 4 percent of the oil produced will be transported by shuttle tanker into Gulf Coast refinery ports. A vessel with a maximum of 50,000 deadweight ton (dwt) capacity (approximately 333,000 bbl of oil) is assumed as the largest size tanker that will be used for shuttle operations.

If such a tanker were involved in an accident during its trip to port, the potential could exist for an oil spill involving 300,000 bbl. It is highly unlikely that the entire cargo would be spilled in the Gulf of Mexico. The soft mud-sand bottom of the Gulf will not completely rip open the hull of a tanker, and the characteristically low wave and wind energy environment of the Gulf will not tend to tear open a foundered ship. Assuming a one-third loss of cargo, a tanker accident could involve 100,000 bbl of oil. If such an accident occurred, it would probably happen on approach to a refinery port. However, it is again unlikely, since refinery ports have a deep channel that can accommodate the draft of the tanker.

Various scenarios were reviewed which considered tanker, pipeline, and platform spilled for different locations and seasons of the year. Based on this review, a scenario was selected that assumes a spill would occur during the winter months at the entrance of the port Arthur ship channel.

At present, shuttle tankers are not being used to transport crude oil from OCS oil facilities in the Gulf of Mexico. Recent indications from industry are that pipelines will be used, instead of tankers, to transport oil from deepwater production sites.

b. Assumptions

It is assumed that in the winter approximately 100,000 bbl of Louisiana crude oil are spilled within 24 hours from a shuttle tanker accident located four miles from the coastline at the entrance to the Port Arthur, Texas, ship channel. The average climatological conditions for this part of the Gulf are assumed at the time of the spill. Winds are blowing from the east at 11 knots (kn), surface drift currents are moving west to northwest at 0.75 kn, and the surface water temperature is 60°F. Severe storm conditions are not assumed because, historically, such conditions have dispersed spilled oil, and no surface slick remains after the passage of the storm. The spill is assumed to occur in 33 ft of water. Tankers transporting crude oil produced as a result of the proposal could be expected to move through this area enroute to refineries at Port Arthur.

The leading edge of the oil is assumed to rapidly wash ashore and contact the shoreline in approximately four hours. Offshore cleanup efforts are assumed to be ineffective at containing a significant amount of the spilled oil, and the use of dispersants is not approved because of the proximity of the sensitive resources. The removal of oil on the beaches is assumed to be effective, and the majority of the oil will be cleaned from recreational beaches after six weeks.

It is assumed that 10 percent of the spilled oil will not move directly to shore but will remain in the nearshore waters, moving with coastal current patterns.

By the end of 3 days, the oil slick is assumed to have been carried onto and along the coast by tidal and longshore currents. The oil is assumed to be stranded along 80 mi of coastline from about 9 mi west of the Sabine River in Jefferson County, Texas, to San Luis Pass at the south end of Galveston Island in Galveston County, Texas. The primary area of potential contact includes a 4 by 80 mi area offshore, the 80-mi stretch of shoreline, and on land, to the extent of the maximum inland movement of the oil. Both the slick moving towards shore and the offshore slick would appear as a series of windrows. Oil slicks do not remain intact as discrete entities; therefore, it is assumed that they would be smeared or streaked over the primary area of contact.

With the exception of barrier passes at the entrance to Bolivar Roads and San Luis Pass at either end of Galveston Island, the entire stretch of coastline within the primary area is fronted by barrier island or chenier ridge beaches. The stranded oil would be deposited on the foreshore areas and lower berms of these beaches for a distance of 100 ft back from the normal low tide line. It is assumed that no stranded oil will move across barrier beaches into back barrier marshes. Any oil that reaches the passes between the two barrier islands, within the primary area of contact, is expected to be transported through these two barrier passes on incoming tides into the back barrier estuarine environment. It is assumed that 5 percent (1,750 bbl) of the oil that reaches the coast will be transported into Galveston Bay, and 1 percent (350 bbl) will be transported into San Luis Pass, based on the percentage of the shoreline that these passes occupy. In addition, it is assumed that 50 bbl of oil will be transported through Rollover Pass, a small breach in Bolivar Peninsula.

The oil that is transported into Galveston Bay is assumed to spread for 6 mi along the back sides of the barrier islands along either side of the barrier pass and for 6 mi along the mainland shore. The oil that is transported into San Luis Pass is assumed to spread for one mile on either side of the pass along the back side of the barrier. Discontinuous wetland areas occur in these settings. Twenty percent of the oil that is transported into the estuary is assumed to move 30 ft back onto these wetlands. Oil deposited in wetlands could accumulate in clumps of marsh vegetation or in protected pools or embayments, resulting in isolated thick layers of oil on such marsh surfaces and in sediments. The rest of the estuarine shoreline consists of bluffs cut into Pleistocene terraces, developed land, and scattered tidal flats. Here, oil will pile up along the shore or will coat the surface of tidal flats. The small amount of oil that is assumed to be transported through Rollover Pass will be deposited onto back barrier wetland areas within a few hundred yards on either side of the pass.

There is some smearing of the oil along the coast, or breakup and reemergence of the weathered oil farther up or down the coast over time. All of the oil that contacts recreational beaches is cleaned up to the extent that oil is not visible and that remnant oil will not interfere with the recreational use of the beach. Onshore efforts to contain or intercept the oil as it reaches the shoreline are ineffective.

Thirty-three percent of the oil would be lost from the slick surface as a result of weathering within 4 hours, the time assumed for the leading edge of the oil to first contact land. About one-half of the amount lost is due to evaporation. In 3 days, it is assumed that the slick contains 35,000 bbl of oil with evaporation accounting for 40 percent of the loss of slick volume. This assumption is based on conditions that allow the slick to spread over a large surface area. By the end of 10 days, a maximum of approximately 50 percent of the oil could be lost due to evaporation and a total of 67 percent of the oil could have weathered from the slick surface. Of the 10 percent of the spilled oil that remains offshore, 60 percent would be lost as a result of weathering after 24 hours. The remaining offshore oil slick would cover less than one square mile of sea surface by 24 hours.

Resources assessed under the proposed program are analyzed below with the exception of the sensitive offshore habitats and communities category. These resources will not be contacted by the oil spill because of the depth of the water where they are located.

c. Environmental Consequences

(1) Impacts on Sensitive Coastal Habitats

COASTAL BARRIERS: The primary threat to a barrier landform from a 100,000-bbl oil spill is the potential for the removal of large quantities of sand in association with cleanup operations. The configuration of a barrier landform is determined by the balance between the sand supply reaching the beach and the erosional processes that are acting to remove the sand. On a sand-deficient beach, if the sand supply is depleted as a result of cleanup operations, the beach could migrate and/or erode in adjustment to the new balance between erosional forces and sand supply. Erosion and migration will cause loss of beach and island area and possible damage to fixed structures on or near the beach (buildings, roads, power lines, etc.).

The length of coast that could be contacted by the spill includes accreting and eroding segments. The Galveston Island shore face is a stable or accreting segment. Cleanup efforts along the Galveston Island shoreline would not have a large impact on beach and island morphology. For example, 90,000 yd^3 of sand were removed from the beaches along middle and western Galveston Island after the tanker *Alvenus* spill (about 67,000 bbl). This amount of sand removal was considered equivalent to the amount that would be removed by a minor storm. By comparison, Hurricane Alicia, a major Gulf hurricane, removed 900,000 yd^3 of sand from Galveston beach. As a result of the cleanup and the associated sand removal, the beach profile changed slightly, but this change was undetectable after a few spring tides.

Along the remaining sections of the coast that could be contacted by the spill, beaches are undergoing varying rates of erosion. Removal of sand from these areas as a result of cleanup operations could alter the cross-sectional and plan configurations of the coastline as a result of beach adjustments to a lowered sand supply. Techniques that do not remove large quantities of sand could be used to clean the beach. These cleanup approaches would probably be more expensive than simply scraping the oiled sand off the beach, but they would result in reduced impacts to the beach.

Impacts to coastal barriers as a result of contact from the assumed spill would be short-term changes in beach profile where sand had been scraped away and not replaced during cleanup operations. No long-term impacts will occur at Galveston Island. Elsewhere, some accelerated erosion of the barrier shoreline may occur where large quantities of sand were removed from the beach and are not replaced. The use of cleanup methods that do not remove sand from the beach will lower erosional impacts.

WETLANDS: Along the coastal area affected by the spill, wetlands occur either in back barrier estuarine settings (Galveston County) or directly behind mainland barrier beaches (Jefferson and Chambers Counties). The continuous length of barrier beach along the coast in Jefferson and Chambers Counties will prevent the spilled oil that is moved onto the beach from being deposited in the wetlands. In Galveston County, oil would be transported through barrier passes at Bolivar Roads (the entrance to Galveston harbor) and at San Luis Pass at the southern end of Galveston Island. There is also a small cut through Bolivar Peninsula that would allow a small quantity of oil to move into the estuary. The total amount of oil that would be transported into wetland areas through these three passes is approximately 2,150 bbl. About five miles of marsh shoreline would be contacted by the oil. If this oil were spread evenly over the contacted marsh area, the concentration of oil on the marsh surface will be approximately 0.017 $gallons/ft^2$. This concentration is below the amount (0.35 $gallons/ft^2$) that was shown to have a detrimental effect on the vigor and survival of *Spartina alterniflora* vegetation in Galveston Bay, Texas, when varying concentrations of oil were applied to the marsh (Alexander and Webb, 1985).

Although it is likely that the oil would be spread across a large expanse of wetlands with the tides, this spreading would not be completely uniform. Lower elevation and protected wetland areas would likely accumulate greater concentrations of oil. Alexander and Webb (1987) have reported that areas of a *Spartina alterniflora* marsh, which had become heavily oiled (5-50 parts of oil per

1,000 parts of marsh soil) after a spill in Galveston Bay, showed significantly reduced growth for 18 months after the spill. Accelerated erosion of marsh shorelines that had received heavy oiling was apparent by 16 months and continued through 32 months. Other areas that had received lighter concentrations of oil were not affected by the spill.

The results of the 1987 Alexander and Webb study provide a realistic scenario for assessing impacts from the occurrence of a 100,000-bbl oil spill in the northwestern Gulf. Investigations that use *Spartina alterniflora* as the test species are useful for the analysis of the impacts of the spill being considered because this grass dominates the vegetation of saline marshes, which will characterize much of the coastal fringe 30 ft back from the shoreline. Furthermore, the Alexander and Webb spill occurred in the same coastal region of Texas and involved a spill with dimensions of the same order of magnitude as the one being considered (160 bbl spilled along 4 mi of coast).

Based on the results of this study, most of the wetland areas contacted by the spill would be unaffected by the oil because the oil on the marsh would have been spread out to a low concentration. Some areas, probably close to the shore, would receive heavier concentrations of oil, resulting in reduced plant vigor and dieback during the following two growing seasons and in accelerated marsh shoreline erosion because of the greater susceptibility of the shoreline to wave attack after the marsh grass roots have died.

The affects of the spilled oil on coastal wetlands are expected to persist for 1-3 years, except in areas where the marsh shoreline has eroded. In these cases, the loss of wetland areas would be permanent. However, only a small percentage of the total wetland acreage in an area contacted by the very large spill would be destroyed or altered as a result of the spill.

(2) Impacts on Water Quality

The effect of oil spills on water quality is determined by the amount of oil that resides within the contacted water body. Significant degradation of offshore water quality is directly proportional to the areal coverage of the surface slick, the concentration of oil transported into the water column, and the residence time of the oil in the water column. The slick itself, defined as the oil spread on the water surface, is a short-lived phenomenon and is only important in determining water quality impacts because of its contribution of hydrocarbons into the water column. The concentration of oil in the surface slick of the 100,000-bbl spill averages 0.0024 gallons/ft^2 of surface water (NRC, 1985a) by the third day of the spill incident.

Major weathering processes removing oil from the surface of the water include spreading, evaporation, dissolution, dispersion (often called vertical transport), photochemical oxidation, adsorption to suspended particulate matter, and microbial degradation. Oil spilled from a subsurface source, such as the tanker spill being considered here, will form a subsurface plume. This plume, although poorly understood, is assumed to rapidly rise to the sea surface to form a surface slick that moves with the currents and winds. Spilled oil can be mixed into the water column primarily through three mechanisms: (1) Oil in the surface slick can be dispersed back into the water due to wave action; (2) Dissolution of the lower molecular weight hydrocarbons would occur from the surface slick and subsurface plume. Dissolution does not play a significant role in the mixing of oil into the water column, usually resulting in less than a one percent loss from the total slick hydrocarbon concentration; and (3) Turbulence in the water, caused by the rapidly rising subsurface plume, would result in the greatest dispersion of water droplets into the surrounding water column during the spill incident.

These weathering processes, which remove oil from the water surface, would be slowed during winter because the processes are temperature dependent. During winter, the average coastal water surface temperature is 61° F.

MARINE WATER QUALITY: The oil spill is assumed to occur from a grounded tanker, 4 mi from the coastline near the entrance to the Port Arthur ship channel. It is assumed that the oil is released from the bottom of the grounded tanker's hull. Oil spilled at the seafloor would form a subsurface plume that rapidly rises to the sea surface to form surface slicks. Two primary slicks are assumed to be formed at the surface of the water over the discharge site. The majority of the floating oil is assumed to be pushed directly toward land. This primary slick becomes stranded along the shoreline within the surf zone in the first 3 days following the accident. Because of shifting winds, however, it is not expected that all of the oil would move directly toward the shoreline. Ten percent of the oil would move as a separate discreet slick, moving westward within nearshore waters.

As described above, oil would become incorporated into the water column in two ways: (1) at the subsurface discharge point, due to turbulence from the rising oil and (2) under the floating surface slicks, due to dispersion and dissolution processes. Concentrations of hydrocarbons in the water column surrounding the discharge point decrease with distance away from the spill, and would likely decrease tenfold seven miles on either side of the plume (USDOI, MMS, 1987b). It is assumed that the majority of the oil dispersed into the water column would occupy the top 20 ft of the water column similar to conditions recorded during the *Ixtoc* spill (Fiest and Boehm, 1980). Therefore, the major volume of water affected by the primary slick moving landward would be 4 mi (distance from shore) by 14 mi (7 mi on each side of the plume) by 20 ft (water depth affected).

The surface slick, formed from the 10 percent of the oil remaining offshore, would persist for approximately 4.5 days before disappearing from the water surface due to the weathering processes. It would cover a maximum area of 1 mi before breaking up. The volume of water affected by this slick would be 1 mi by 20 ft.

Calculations of the maximum amount of oil within the water column were then made for the affected areas. Approximately 9,000 bbl of oil would be contained in the water column after 3 days under the major surface slick heading towards shore, and about 2,600 bbl of oil would be contained under the offshore slick after 4 days. Given all of the above, maximum hydrocarbon loadings of the affected waters would be 30,000 ppb. This figure is very high when compared to the average reported concentrations of oil in pristine waters of less than l ppb (Fiest and Boehm, 1980).

It is assumed that the contaminated water would mix with surrounding water and would become diluted. After several weeks, enough mixing would take place so that, within the primary area of contact, hydrocarbon quantities would approach background levels. In conclusion, hydrocarbon concentrations would change in the primary area of contact by several orders of magnitude. This would persist for days to weeks.

ESTUARINE AND NEARSHORE WATER QUALITY: It is assumed that the slick will spread out along the shore, contacting 80 mi of west Texas chenier ridge beaches and barrier islands by the end of 3 days. Nearshore coastal water quality adjacent to the contaminated 80 mi would be affected by the oil due to backwashing of the oil into the surf zone. Oil returning to the surf would likely be trapped by longshore currents and, therefore, would remain within nearshore waters. Surf conditions would accelerate the amount of hydrocarbons dispersed into the shallow water column. Therefore, in nearshore waters contacting the beaches, it is expected that hydrocarbon concentrations would be significantly higher than background levels. Waters containing significantly higher levels of hydrocarbons than background levels are assumed to be contaminated and of poor water quality. This contamination would continue until the source of the contamination, the oil on the beaches, is removed. Cleanup of beaches is assumed to be completed in about 6 weeks. Prior to this time, it is assumed that the longshore currents would continually be carrying some contaminated water westward beyond the primary area of contact. The contaminated water that remains after the beaches are cleaned would mix with surrounding water as it moves westward with nearshore currents and become diluted to background levels within several weeks. It is, therefore, expected that the 100,000-bbl spill would significantly alter the water quality of Texas nearshore waters for several weeks.

It is assumed that 2,100 bbl of the oil would reach the back bay area behind Galveston Island through the Bolivar Roads and San Luis Pass inlets. Another 50 bbl of oil would enter the back barrier area through the Rollover inlet, a small channel through Bolivar Peninsula. Of the 2,150 bbl of oil that enter the inland coastal waters, 430 bbl are assumed to reach coastal wetlands along a total of 5 mi of bay shoreline. The oil would move back 30 ft into wetland waters. The majority of the oil covering wetlands would weather, and quantities of hydrocarbons would likely return to background levels within several months after the spill occurred. The colder weather occurring in the winter would impede weathering processes so that the oil may remain above ambient conditions until warmer weather returns. Some of the oil, however, could be pushed into clumps of marsh vegetation or into protected pools or embayments, resulting in a thick layer of oil on these water bodies or marsh surfaces. Dissipating factors reducing the concentrations of oil would operate slower due to the low energy of the isolated water bodies, due to the thickness of the oil on the marsh surface, and due to the cold weather. These isolated pools of oil would weather more slowly and may release oil into the surrounding water bodies for a much longer time period. Past studies documented that this type of dense oiling has occurred, releasing oil from oiled sediments and vegetation for over 1 year from the time of the spill.

(3) Impacts on Air Quality

Emissions into the air due to evaporation of total hydrocarbons would occur in the Port Arthur and Galveston area as a result of this oil spill. Evaporative emissions would discharge a number of volatile organic compounds (VOC) into the atmosphere. These compounds are a constituent in the formation of photochemical oxidants (O_x) known as ozone.

Approximately 17 percent of the oil spill would enter the atmosphere during the first 4 hours and prior to oil contacting land. The greatest amount of evaporation would take place the first hour near the spill site. During succeeding hours, evaporation would continue at a decreasing rate. It is estimated that at a maximum 40 percent of the oil spill will evaporate by the end of 3 days. By this time the slick would have contacted the coast. The difference between the amount lost during the first four hours and the amount lost at the conclusion of the 3-day period is 23 percent. Within 5 days of the spill occurrence, 42 percent of the oil would evaporate, assuming that the slick has spread over its maximum area inshore. By the end of 10 days, 50 percent evaporation would have occurred and further emissions into the atmosphere would be minor.

Evaporative emissions from this oil spill, under expected climatic conditions present during the winter, could impact localized air quality during the period of evaporation (10 days). The intensity and duration of impact would be affected by wind and water temperature, wind direction, speed, and the amount of sunshine present. In the Port Arthur and Galveston areas, winds are assumed to be easterly and wind speeds would average 11 kn. Water temperature averages 61°F during the spill event.

Visibility could be reduced to less than 1,000 ft under stagnant air/sunny day conditions in the general spill area early in the event. These conditions are unlikely to persist in the Gulf region over 24 hours due to variable coastal winds and relatively flat terrain in the coastal area. The addition of VOC into the atmosphere could contribute to increased ozone levels in the coastal environment. During the winter season the potential for high, localized, short-term (24 hours) air quality impacts exist as a result of this oil spill.

(4) Impacts on Endangered or Threatened Species

The following threatened and endangered species and their habitats between San Luis Pass and Sea Rim State Park, Texas, could be impacted by a 100,000-bbl spill or its subsequent containment/cleanup operations because they are located within the area of potential impact: piping plover; bald eagle; Arctic peregrine falcon; brown pelican; and the Kemp's ridley, green loggerhead, and hawksbill sea turtles. If these animals or their habitat were contacted by spilled oil or were in proximity to the resultant containment/cleanup operations, the impacts could include mortality or displacement of food, displacement from critical habitats, mortality or dysfunction from ingestion or contact, reduced reproductive capacity, and debilitating or terminal stress. These impacts could be acute as well as long term and could impact all life stages from prenatal to adult. Protected species that occur in the area of potential impact, include leatherback sea turtles, and the great whales (blue, sei, right, fin, and sperm). The marine species occur farther offshore than the spill would contact, and the terrestrial species occur inland of the landward extent of the spill.

PIPING PLOVER: The piping plover migrates to and congregates along the sandy shores of the central and western Gulf Coast during the winter. Based on the scenario, the spill and cleanup/containment operations would contact piping plover habitat in Bolivar Flats and San Luis Pass, Texas. The spill, occurring during the winter, could contact the piping plover and its habitat because the bird's primary congregating, feeding, resting, and roosting areas are within the area of impact (i.e., 30 ft of the mean low tide on Gulf Coast sandy shores). Impacts to the birds from such a contact are discussed in the first paragraph of this section. A significant portion of the population is assumed to be in the area of impact because the fourth largest piping plover aggregation, which was observed in a 1987-1988 survey, was located at Bolivar Flats, with a smaller aggregation at San Luis Pass. A significant portion of the species or its habitat could come in contact with oil or cleanup/containment operations (i.e., 100 ft shoreward of the normal low tide line). It is likely that a significant portion of the local population could die or be reproductively disabled as a result of contact; such mortality has been documented. A local population decline of 5 percent or more could occur, and this decline would take more than three generations to recover. Such losses would eliminate the piping plover from up to 80 mi of its wintering range and would reduce the gene pool of the species to a point that could impair its ability to recover.

ARCTIC PEREGRINE FALCON: The Arctic peregrine falcon migrates through and concentrates along the coast of the western and central Gulf of Mexico during the spring, fall, and winter. The greatest threat to peregrine falcons from the spill is the external oiling and toxic ingestion of oil during and after the capture of oiled prey. Based on the scenario, the spill and cleanup/containment operations would contact Arctic peregrine habitat in coastal Texas between San Luis Pass and Sea Rim State Park. A spill occurring during the winter could contact Arctic peregrine falcons and their habitat because the birds' primary feeding areas are within the area of impact (i.e., 30 ft of the mean low tide on the central and western Gulf Coast). Impacts to the birds from such a contact are discussed in the first paragraph of this section. A significant portion of the population is assumed to be in the area of impact because the North American Arctic peregrine population concentrates in a coastal corridor from Louisiana through Mexico during its spring, fall, and winter migration. A significant portion of the species or its habitat is likely to come in contact with oil or cleanup/containment operations because the peregrine's prey inhabit the area of potential impact. It is likely that a significant portion of the population could die or be reproductively disabled as a result of contact; such mortality has been documented. A population decline of 5 percent or more could occur and this decline could take more than three generations to recover. Such losses would be acute, as in the case of birds starving because of their inability to fly after being oiled, or long term, where oil ingestion results in infertile or thin-shelled eggs.

BROWN PELICAN: The brown pelican is protected in Louisiana and Texas because of population declines in these states. The protected population nests in lower Laguna Madre, Corpus Christi Bay, and Aransas Bay in Texas, and Barataria Bay and Mississippi Sound in Louisiana. The majority of the species occurs in a healthy, unprotected population along the Gulf Coast of Florida. Based on the scenario, the spill and cleanup/containment operations could contact brown pelicans and their habitat in Galveston Bay. The spill, occurring during the winter, could contact the brown pelican and its habitat because the bird's primary congregating, feeding, resting, and roosting areas are in the area of impact (i.e., in coastal waters or within 30 ft of the mean low tide). Impacts to the birds from such a contact are discussed in the first paragraph of this section. A significant portion of the protected brown pelican population is not assumed to be in the area of impact because no nesting rookeries exist in the Galveston Bay area. A significant portion of the protected population or its habitat will, therefore, not come in contact with oil or cleanup/containment operations. However, that portion of the population that occurs in the Galveston Bay area is at risk because the bird's primary habitat is within the area of potential impact. The portion of the population in Galveston Bay could die or become reproductively disabled as a result of contact; such mortality has been documented. A local population decline of 1 percent or less could occur and this decline could take one generation to recover.

BALD EAGLE: The bald eagle is endangered throughout most of the Nation. They occur throughout the continental United States and Alaska including the Gulf of Mexico coast. They build nests near water and hatch eggs from November to April. Eagles feed primarily on fish, shorebirds and waterfowl, often preferring carrion over predation. Based on the scenario, the spill and cleanup/containment operations could contact bald eagle habitat between Sea Rim State Park and San Luis Pass, Texas. The spill, occurring during the winter, could contact the bald eagle and its habitat because the bird's primary feeding areas are in the area of impact (i.e., in coastal waters or 30 ft of the mean low tide). Impacts to the birds from such a contact are discussed in the first paragraph of this section. A significant portion of the local population would not be in the area of impact because no nests are reported for the area of primary impact. A significant portion of the species or its habitat would not come in contact with oil or cleanup/containment operations because of the small number of eagles in the area of potential impact. A small portion of the population could die or be reproductively disabled as a result of contact; such mortality has been documented. A local population decline could occur but birds from the interior would recolonize coastal areas within a generation. Such losses would be acute, as in the case of a birds starving because of their inability to fly after being oiled, or long term, where oil ingestion results in infertile or thin-shelled eggs.

SEA TURTLES: Five species of sea turtles occur in the northern Gulf of Mexico. The loggerhead and Kemp's ridley sea turtles are the only species that nest in the central and western Gulf of Mexico. For the purposes of discussion, this analysis will concentrate on these two species because more is known about their distribution and abundance in the Gulf of Mexico. Based on the scenario, the spill and cleanup/containment operations would contact sea turtle habitat between Sea Rim State Park and San Luis Pass, Texas. The spill, occurring during the winter, could contact sea turtles and their habitat because their primary feeding areas are in the area of impact (i.e., in coastal waters and on land within 30 ft of the mean low tide). Impacts to the turtles from such a contact are discussed in the first paragraph of this section. Although little is known about the distribution and abundance of sea turtles, however, it is assumed that a significant portion of the sea turtle populations do not occur in the area based on the few sightings that have been reported in the area. The exception is the Kemp's ridley turtle, which periodically strands in large numbers along this portion of the coast. Although mortality from contact and ingestion of oil has been documented, a significant portion of the population would not be affected, except in the case of the Kemp's ridley. A population decline of 1 percent or less could occur and this decline could take one generation to recover for loggerhead, hawksbill, and green turtles. The Kemp's ridley could sustain a population decline percent, which could last as long as two to three generations.

(5) Impacts on Marine Mammals

Twenty species of nonendangered marine mammals occur in the northern Gulf of Mexico. Eight species have been observed with regularity, the bottlenose dolphin being the most common. The bottlenose dolphin is the only species that would be contacted by the spill because they occur nearshore within the primary area of potential contact in the spill scenario. All other species would not contact or be impacted by the spill or its cleanup operations because they occur outside the primary area of impact. Contact with bottlenose dolphins would result in mortality and dysfunction as a result of skin irritation, displacement from preferred habitats, ingestion, and loss of food sources. The impact on dolphins would be greatest in those populations that have high accumulations of toxic metabolites and during periods of poor water quality (i.e., red tide). The impacts could result in local population declines that last for one generation.

(6) Impacts on Coastal and Marine Birds

The back barrier estuarine environment, barrier islands, beaches, and nearshore waters of Chambers, Jefferson, and Galveston Counties in Texas are populated by both migrant and resident species of waterfowl, wading birds, and shorebirds. Refer to Section IV.A for a detailed discussion of the effects of oil on coastal and marine birds.

A 100,000-bbl spill 4 mi off Port Arthur, Texas, would contact barrier islands and beaches on the Texas coast. Most of the oil (90%) would come ashore. The oil would wash ashore 100 ft back from the normal low tide line. Approximately 1,750 bbl of the oil would be transported through Bolivar Roads Pass into Galveston Bay and the back barrier estuarine environment, spreading 6 mi across from and 6 mi both east and west of the Pass. Approximately 50 bbl of the oil would be transported through Rollover Pass into the back barrier estuarine environment, spreading a few hundred feet across from and a few hundred feet both east and west of the Pass. Approximately 350 bbl of the oil would be transported through San Luis Pass into Redfish Cove and the back barrier estuarine environment, spreading 1 mi across from and 1 mi both east and west of the Pass.

The majority of the waterfowl population (e.g., ducks and geese) are overwintering migrants. The occurrence of a large spill during the winter would contact those duck species of the central flyway that migrate to the back barrier estuarine environment, barrier islands, beaches, and nearshore waters found in Chambers, Jefferson, and Galveston Counties. These ducks (e.g., lesser scaup, mergansers, and fulvous whistlers) are gregarious and feed on marine fish and shellfish while in coastal areas.

Wading birds (e.g., herons, egrets, and ibis) are both overwintering migrants and residents of the Texas coast and would be vulnerable to contact from a large spill. Major wading bird habitats include the protected bays, back barrier estuarine environment, barrier islands, and open beaches found in Chambers, Jefferson, and Galveston Counties. Under the spill scenario, wading birds that occupy the foreshore area of the islands and the oiled areas of the back barrier estuarine environment near the barrier passes would be contacted by oil.

Shorebirds (e.g., gulls, terns, sandpipers, and shearwaters) are both overwintering migrants and residents of the Texas coast and would be vulnerable to contact from a large spill. Shorebirds are closely associated with the marine environment. Major shorebird habitats include the back barrier estuarine environment, barrier islands, open beaches, and nearshore waters found in Chambers, Jefferson, and Galveston Counties. Under the spill scenario, birds roosting in the nearshore part of the primary area of potential contact (80 mi along the coast by 4 mi offshore) would be contacted by oil. In addition, shorebirds that occupy the foreshore area of the islands and the oiled areas of the back barrier estuarine environment near the barrier passes would be contacted by oil. Shorebirds nest on the barrier islands of Chambers, Jefferson, and Galveston Counties, between the dunes and the normal low tide line. Under the spill scenario, these nesting sites would be contacted and contaminated by oil. However, beach cleanup operations would be completed within 6 weeks of the spill before shorebird nesting activities take place on these beaches in the spring. Therefore, it is expected that shorebird nesting sites would not be impacted from a large oil spill.

It is expected that contact between the spilled oil and birds associated with the coastal area in the settings described above would result in both lethal and sublethal impacts on the contacted birds. It is expected that no more than 1,000 birds associated with the coastal area will be contacted by the spilled oil. Direct contact between partially weathered oil and adult birds would result in lethal impacts, whether or not the birds were completely oiled, due to ingestion and toxic poisoning, drowning, or hypothermia. Direct contact between heavily weathered oil and adult birds would result in sublethal impacts including decreased survival and fecundity and modifications of normal behavior. Any oil remaining in the protected bays and back barrier estuarine environments found in Chambers, Jefferson, and Galveston Counties would exist as probable contaminated areas or sources of contaminated food for several months. Adults of both resident and migrant birds associated with the coastal area would be susceptible to sublethal impacts from feeding in these contaminated areas or on contaminated food. Within the limited geographical area affected, both migrant and resident coastal bird populations would decline and change their distribution and/or abundance for one to two generations or for 2 to 3 years.

(7) Impacts on Commercial Fisheries

Commercial fisheries in the Gulf of Mexico are dominated by estuarine-dependent species. The back barrier estuarine environment, nearshore waters, and passes of Chambers, Jefferson, and Galveston Counties in Texas serve as nursery grounds and immigration routes for eggs, larvae, and/or juveniles of commercial finfish and shellfish that are spawned offshore. Refer to Section IV.A for a detailed discussion of the effects of oil on finfish and shellfish.

A 100,000-bbl spill four miles off Port Arthur, Texas, would contact barrier islands and beaches on the Texas coast. Most of the oil (90%) would come ashore. The oil would wash ashore 100 ft back from the normal low tide line. Approximately 1,750 bbl of the oil would be transported through Bolivar Roads Pass into Galveston Bay and the back barrier estuarine environment, spreading 6 mi across from and 6 mi both east and west of the Pass. Approximately 50 bbl of the oil would be transported through Rollover Pass into the back barrier estuarine environment, spreading a few hundred feet across from and a few hundred feet both east and west of the Pass. Approximately 350 bbl of the oil would be transported through San Luis Pass into Redfish Cove and the back barrier estuarine environment, spreading 1 mi across from and 1 mi both east and west of the Pass.

Important commercial fisheries species in Chambers, Jefferson, and Galveston Counties that could be contacted by the oil spill include brown shrimp, blue crab, American oyster, flounder, and several species of sciaenids. All stages of larval shrimp are distributed within the upper portion of the water column while nearshore. Postlarval shrimp become benthic after entering nursery grounds. Young blue crabs are distributed within the upper portion of the water column while nearshore. Blue crabs become benthic after entering nursery grounds, but retain the ability to swim for short distances especially with tidal currents. Oyster larvae remain within back barrier environments and once settled as adults do not change location. Except for flounder, young finfish are distributed within the upper portion of the water column while nearshore. Juvenile finfish remain pelagic in back barrier estuarine environments, but occupy shallow water areas along with young flounder.

The greatest potential for damage to commercial fisheries would occur when oil contacts nearshore waters and back barrier estuarine environments during the time when high concentrations of planktonic larvae, or developing young, are present. Young finfish and shellfish (e.g., shrimp, blue crabs, and sciaenids) would be vulnerable to contact from a large spill. Under the spill scenario, young finfish and shellfish would be contacted by oil as they migrate from nearshore waters through the primary area of potential contact (80 mi along the coast by 4 mi offshore) into back barrier estuarine environments found in Chambers, Jefferson, and Galveston Counties. Under the spill scenario, all life stages of oysters that occupy the oiled areas of the back barrier estuarine environment near the passes would be contacted by oil.

It is expected that contact between the spilled oil and important commercial fish and shellfish species in the settings described above would result in both lethal and sublethal impacts on the contacted species.

Direct contact between partially weathered oil and the eggs, larvae, or juvenile stages of finfish or shellfish would result in lethal impacts, due to ingestion and toxic poisoning and/or uptake of dissolved oil through the epithelium or gills and toxic poisoning. Direct contact between heavily weathered oil and juvenile fish and shellfish would result in sublethal impacts including decreased resistance to disease and reduced growth rates. Any oil remaining in the protected bays and back barrier estuarine environments found in Chambers, Jefferson, and Galveston Counties would exist as probable contaminated areas or sources of contaminated food for several months. Juvenile finfish and shellfish would be susceptible to sublethal impacts from feeding in these contaminated areas or on contaminated food. In addition, low concentrations of the spilled oil could taint the flesh of adult oysters rendering them unmarketable.

Fishermen tend to fish within a limited, traditional area. This area may be only hours from their home port. Fishermen are reluctant and often unable to switch gear type or to change target species. Within the limited geographical area affected, commercial fisheries would be depressed with local fishermen out of work and secondary employment affected for 1 to 2 years after the spill.

(8) Impacts on Recreational Resources and Activities

A 100,000-bbl oil spill affecting up to 80 miles of north Texas coastline between the Sabine River and San Luis Pass would have short-term adverse impacts on several designated park areas and general-use beach areas, extending the entire length between Sabine Pass and Galveston Island. Sea Rim State Park, a 5.2-mile stretch of designated beach park in Jefferson County, would likely receive the initial oiling from an assumed spill off Port Arthur. About 5-10 percent of annual visitations occur during the winter season and consist mainly of recreational vehicle campers traveling the Gulf Coast. The attention associated with a major winter spill could even attract more winter leisure travelers to the park than normal. Within the first 2 days after the spill, intermittent oiling of the extensive dispersed use recreational beaches fronting on Jefferson and Chambers Counties would be adversely affected also. By the third day, the 9 mi of Gulf recreational beaches associated with the City of Galveston Island, Galveston Island State Park's 1.5 mi of beachfront, and Seawolf Park are likely to be impacted by residual oil from the spill. Although beach use, particularly swimming and sunbathing, declines appreciably after Labor Day, residual use of coastal beach parks, pier, jetty, and surf fishing continues through the fall and winter months, especially in Galveston County. Very little recreation activity is focused on beach activities in Galveston County during the winter months, but publicity associated with a large spill event, which pollutes the city's major natural recreational amenity, is likely to result in some cancellations of discretionary leisure travel planned to the city of Galveston and may discourage attendance at Sea Wolf Park.

In general, the socioeconomic impact of a large oil spill on beach communities is unlikely to be severe during the off season but would preclude or detract from public use and enjoyment of directly impacted beaches for several days on up to 6 weeks, depending on current, tides, weather, access, and cleanup effectiveness. Cleanup of beaches extensively affected by crude oil is labor intensive and can result in beach closures and sand displacement, removal, and disposal problems. As noted from the large spills and accidents that have impacted major Gulf of Mexico beaches with oil in the past, recreational use and enjoyment of coastal beaches and shoreline fishing platforms return to normal after evidence of the spill was gone.

2. Alaska Region

a. Introduction

The Pribilof Islands were chosen for the analysis of a 1,000,000-bbl oil spill because of the diversity of exposed sensitive resources considered representative of the region. The Pribilof Islands, located approximately 480 kilometers from the Alaskan mainland and 290 km north of the Aleutian chain, serve as a breeding and haulout area for over 800,000 northern fur seals and contain even greater populations of nesting sea birds.

b. Assumptions

A nearshore tanker spill occurs with onshore winds in August. The 150,000 dwt tanker releases about 1,000,000 bbl of crude oil intermediate in composition between Prudhoe Bay and Cook Inlet crude oil. It is assumed weather conditions hamper cleanup activities and the oil is rapidly washed ashore, contacting the coastline within hours and affecting the exposed portion of the area within 60 days after its release. To assist in developing the scenario for the spill reaching the Pribilof Islands, the conditional probabilities from hypothetical launch points presented in the FEIS for the Navarin Basin Oil and Gas Lease Sale 107 were reviewed(USDOI, MMS, 1991b).

The hypothetical oil spill occurs approximately 28 km due east of St. Paul Island. The current regime in the vicinity of this spill is characterized by a counter clockwise eddy with the center in the vicinity of the Pribilof Islands. The minimum time for a trajectory to reach shore is an hour. It is assumed that within an hour, oil begins to come ashore on the eastern side of St. Paul Island. By the end of day 10, the oil comes ashore at St. George Island. By the end of day 30, oil comes ashore on the southern side of Nunivak Island.

Using the oil-weathering model of Payne, Kirstein, and Redding (1983) and the mass balance estimates from the *Amoco Cadiz* spill (Gundlach and Boehm, 1981a), a qualitative mass balance for an oil spill of about 1,000,000 bbl is presented in Table IV.H-1. Most of the oil is dispersed into the water column. A large component comes ashore on St. Paul Island with evaporation being the third greatest oil-removal factor. After 60 days, the 192,802 bbl represented by the slick is no longer visible as a coherent slick. The remaining oil is in the form of tarballs and tar particles suspended in the water column.

Table IV.H-1. Mass Balance of Oil Through Time of a 1,000,000-bbl Oil Spill near the Pribilof Islands[1]

Day	Slick	Evaporated	Dispersed	Sedimented	Onshore
1	828,192	125,211	21,981	35,359	123,756
3	655,281	165,581	54,337	38,134	133,472
10	461,433	208,014	151,172	42,436	148,529
30	278,932	241,176	278,427	55,268	193,438
45	224,729	252,325	321,026	66,390	232,366
60	192,802	259,946	348,064	77,132	269,963

Source: USDOI, MMS, 1991b.

[1] In barrels.

As stated in the mass balance, approximately 270,000 bbl would be onshore after 60 days. Sixty-eight percent—183,074 bbl—would landfall on the Pribilof Islands. On the Pribilofs, about half of this oil would contact wave-cut platforms and rocky headlands—shorelines with low oil-retention capabilities (Gundlach et al., 1981). On some of the headlands, spilled oil would be held offshore by waves reflecting off the steep cliffs. Oil that impacts the shoreline would be rapidly removed by wave activity during the following days to weeks.

Approximately 16 percent of the oiling would occur on gravel beaches on the Pribilof Islands. The spilled oil would persist primarily in the more sheltered areas between the boulders. Recovery would depend on the extent of damage and the proximity of healthy organisms able to repopulate the area. Theoretical calculations of slick size from a spill of about 1,000,000 bbl were investigated using the equations of Ford (1985a) and Payne, Kirstein, and Redding (1983). Table IV.H-2 shows the areal extent of a continuous thick slick and a discontinuous slick through time.

The length of shoreline affected is calculated from the equations of Ford (1985a). The equation describes the median length of coastline affected from empirical studies. Table IV.H-3 presents calculations of the median number of km of coastline which would be potentially affected by a spill of about 1,000,000 bbl. The median number of km of coastline potentially affected is greater than the amount of shoreline available. This, therefore, indicates there is the potential for 100-percent-shoreline coverage.

Table IV.H-2. Area of Discontinuous and Thick Slick from an Oil Spill of About 1,000,000 Barrels Near the Pribilof Islands[1]

Day	Median Area of Discontinuous Slick[2]	Area of Thick Slick[3]
1	104	17
3	402	24
10	1,743	39
30	6,324	59
45	10,126	69
60	14,143	76

Source: USDOI, MMS, 1989.

1. Square kilometers (km^2).
2. Calculated from Ford (1985).
3. Calculated from Payne, Kirstein, and Redding (1983).

Table IV.H-3. Median Number of Kilometers of Coastline Which Would be Affected by a Spill of About 1,000,000 Barrels Through Time[1]

Day	Coastline Available Along Trajectories	Potential Amount of Coastline Affected[2]	Potential Coverage
1	73	516	100%
3	127	481	100%
0	127	441	100%
30	247	389	100%
45	unknown	370	unknown
60	unknown	357	unknown

Source: USDOI, MMS, 1991b

1. Median number in kilometers (km).
2. Calculated from Ford (1985a).

Hydrocarbon concentrations through time in the water column underneath the spill were calculated from mass-balance considerations and are summarized in Table IV.H-4.

Table IV.H-4. Water-Column Concentrations of Dispersed Oil Resulting from a 1,000,000-bbl Oil Spill near the Pribilof Islands

	Concentrations in Water Column Below Discontinuous Slick[1]					
At end of:	**1 day**	**3 day**	**10 days**	**30 days**	**45 days**	**60 days**
Average concentration if all dispersed in top 80 meters:	0.36[1]	0.23	0.13	0.07	0.05	0.04

Source: USDOI, MMS, 1991b.

1. Measured in ppm.

c. Environmental Consequences

(1) Impacts on Air Quality

A 1,000,000-bbl oil spill is an accident not generally accommodated by air-quality standards. Consequently, the effects of such an oil spill on air quality are similar to those described for effects not related to standards for smaller accidental oil spills described in Section IV.D.1.a but on a larger scale. The primary effects on air quality would be evaporation of gaseous hydrocarbons from the slick and (possibly) smoke from the burning of the slick. Mass-balance-weathering calculations indicate that of about 1,000,000 bbl (142,800 t) spilled evaporation would account for approximately 22,519 t after 3 days, 28,290 t after 10 days, and 32,800 t after 30 days. Evaporation thereafter would be negligible. These values correspond to approximately 2,252, 2,829, and 3,280 t, respectively of VOC released to the atmosphere through time for 3, 10, and 30 days. It is expected that although the gaseous hydrocarbons may be carried toward land, they would disperse quickly, particularly during the stormy conditions under the spill scenario. If the oil is ignited immediately after spillage, burning could combust 33 to 67 percent of the crude oil or higher amounts of the crude oil that could otherwise evaporate. Incomplete combustion of oil injects approximately 10 percent of the crude oil into the air as oily soot and lesser amounts of other contaminants (Table IV.H-5). Effects would to be temporary but locally intense due to heat and coating from soot as the burning slick nears the shore. Emissions would cause measurable increases in concentrations of certain pollutants over more than one half of a Federal attainment area resulting in the consumption of at least 20 percent of the available PSD increment for NO_2 and SO_2 and 5 percent of the available NAAQS concentration for PM_{10}, CO, or O_3.

(2) Impacts on Water Quality

Following the spill the more volatile compounds in the slick, particularly aromatic volatiles, would decrease significantly. In situ, cold-water measurements have demonstrated that individual compounds in a slick decrease significantly in concentration in hours to tens of days. Over the first 10 days of a spill, only about 5 percent of a slick can be expected to dissolve (Butler, Morris, and Sleeter, 1976, as cited by Jordan and Payne, 1980). High-dissolution rates of aromatics from a slick, and accumulation in the underlying water, occur in the first few hours of a spill. By the time dissolved

Table IV.H-5. Emissions from Burning an Oil Spill of About 1,000,000 Barrels

Pollutant	Metric Tons of Pollutant
Total Suspended Particulates (TSP)[1]	1,365
Sulfur Dioxide (SO_2)[2,3]	9,030
Volatile Organic Compounds (VOC)[2]	53
Carbon Monoxide (CO)[4]	9,345
Nitrogen Oxides (NO_x)[4]	399

Source: USDOI, MMS, 1991b.

1. Estimated as 10 percent of the total burn, less residue.
2. Burning assumed to be the same as residual oil firing in industrial burners. Emissions calculated from factors in Frazier, Maase, and Clark (1977).
3. Assumes a sulfur content of 2.9 percent.
4. Emissions calculated from factors in Evans, 1986.

oil has worked down 10 m in the water column, it would have been diluted and spread horizontally about 10,000 m. The slick would have become patchy, with a total area containing widely scattered patches of oil being orders of magnitude larger than the actual surface area covered by oil. Horizontal advection changes the water under the slick continuously, and aromatics do not continue to accumulate in the same water. The 1,000,000-bbl spill would have a discontinuous area of 1,743 km^2 after 10 days and 14,143 km^2 after 60 days (Table IV.H-2).

Major spills generally result in peak, dissolved-hydrocarbon concentrations that are only locally and marginally at toxic levels. Concentrations of hydrocarbons, in the water column, following the *Argo Merchant* spill varied greatly with concentrations ranging up to 0.34 ppm. A concentration of 0.25 ppm was detected under the spill despite the presence of 20 percent by volume of the more soluble cutting stock. Volatile liquid hydrocarbons in the *Ixtoc* spill decreased from 0.4 ppm near the blowout to 0.06 ppm at a 10-km distance and to 0.004 ppm at a 19-km distance from the blowout. Following the *Amoco Cadiz* spill, hydrocarbon concentrations in the water column varied widely with concentrations ranging from 0.003 to 0.02 ppm offshore and 0.002 to 0.2 ppm nearshore. Hydrocarbon concentration in the water column, following the hypothetical spill near the Pribilof Islands, would be expected to decline rapidly in the first 60 days following the spill. The average concentration after 1 day in the top 80 m of the water column below the discontinuous slick are estimated to be 0.36 ppm. The discontinuous slick would cover 104 km^2 after 1 day. The average concentration, in the top 80 m of the discontinuous slick, would be expected to decline to 0.13 ppm, after 10 days, and to 0.04 ppm after 60 days following the spill. The mean area of the discontinuous slick would reach 1,743 km^2 after 10 days and 14,143 km^2 after 60 days.

After the slick disappeared (after 60 days) the spilled oil would persist as tarballs and tar particles suspended in the water column. Slow photo-oxidation and biological degradation would continue to slowly decrease the residual amount of oil. Through 1,000 days, about 15 percent of the tar balls would sink, with an additional 20-percent slick mass persisting in the tar balls (Butler, Morris, and Sleeter, 1976, as cited by Jordan and Payne, 1980). Because of the drift of the oil over distances of hundreds of km during the slow process of sinking, individual, sunken tar balls would be widely dispersed in the sediments.

Sustained degradation of water quality to levels above State and Federal criteria from hydrocarbon contamination is unlikely. Hydrocarbon concentrations from an oil spill of about 1,000,000 bbl would exceed the chronic criterion of 0.015 ppm total hydrocarbons on more than 1,000 km^2. Concentration above the acute criteria (1.5 ppm) are not anticipated. The persistence of individual oil slicks would be short-term (less than 1 year). The concentrations of contaminants resulting from the oil spill could average more than the chronic State standard or USEPA criteria but would not exceed acute (toxic) State standards or USEPA criteria.

(3) Impacts on Threatened or Endangered Species

CETACEANS: As described above, the hypothetical oil spill would occur from a tanker spill (about 1,000,000 bbl) near the Pribilof Islands in August. The whales use areas around the Pribilofs and the shelf-break areas north and south of the islands would be the only whale use areas that would likely be contacted by the spill.

Small numbers of gray whales that use the Pribilof area during the summer would be affected by the spill. Also, individual fin, right, humpback, and sperm whales, although found in small numbers in this area could be affected. The bowhead would not be affected since they would be on their summering grounds and in fall migration in the Beaufort and Chukchi Seas. In general, whales may experience skin contact with oil, temporary baleen fouling, inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of oil contaminated prey, and perhaps temporary displacement from areas as the result of the spilled oil, or from the noise and disturbance due to cleanup efforts. The reader is directed to Sections IV.A and IV.D.1.a for a discussion of the effects of oil on whales. Given the small numbers of whales found in these affected areas, it is likely that a small number of individuals may be affected by the oil spill. Also, due to cetaceans' ability to travel and forage over a wide area and the apparent abundance of foraging habitat, displacement would only result in a localized, minor change in the distribution of populations of gray, fin, humpback, and sperm whales that would last from 2 to 5 years. However, due to the populations numbers of right whales (150 to 200 maximum), any effect to a few individuals would result in a higher level of effect to the entire population.

The effect of the oil spill on the bowhead whale is expected to result in no discernible population decline (lethal effects) but a number of individuals may experience sub-lethal effects and recover full capacity within one year. The effect on the fin, gray, sperm, right, and humpback whales is expected to result in lethal effects to a small number of individuals resulting in minor changes in the distribution and/or abundance of the species. The effects on the right whale would result in a substantial population decline.

STELLER SEA LION: Adult and subadult sea lions could experience adverse effects if heavily oiled, but the potential severity and likelihood of mortality is not well known. Newborn Steller sea lions also could be vulnerable during the period when insulation is provided primarily by the pelage which could become fouled by oil transferred from females returning through areas contacted by a spill.

The discontinuous nature of any spill suggests that a certain, often substantial, proportion of the area covered actually is oil free at any particular instant; however, since spills are dynamically influenced by winds and currents, the area over which patches and streamers of oil sweep essentially becomes equal to the area likely to be covered by a discontinuous slick in a given period. This has important implications for sea lions, that frequently concentrate at traditional foraging areas where prey are abundant, in that a particular area occupied by successive groups or a constant procession of foragers may be contacted repeatedly by slicks from a large spill over a protracted interval, and thereby greatly increasing the numbers of animals potentially oiled. Likewise, individuals that return to the same foraging area repeatedly would risk multiple exposure from returning to the islands after each foraging trip, since it is assumed that the Pribilof coastline would be 100 percent contacted. Sea lions generally forage within 25 km of the islands; this area would be likely to be heavily oiled.

The local Pribilof sea lion population, especially newborn sea lions, could experience substantial adverse effects from a large spill. The Steller sea lion population would be expected to experience a decline that results in a local change in the distribution and/or abundance of the species requiring three generations (18 years) or more for recovery.

SHORT-TAILED ALBATROSS: The effects to the short-tailed albatross (the only endangered or threatened bird species in the affected oil-spill area) would be minimal. Since the population is very small and is dispersed over a wide oceanic range, only a limited encounter would occur with the 1,000,000-bbl oil spill, which could result in a minor change in distribution and abundance due to a loss of some individual birds from contact with oil. The effect on the short-tailed albatross is expected to result in lethal effects to a small number of individuals resulting in minor changes in the distribution and/or abundance of the species.

(4) Impacts on Nonendangered Cetaceans

Minke, beluga, and killer whales and Dall's and harbor porpoises use the waters around the Pribilof Islands. Sea beaked, giant bottlenose, and goosebeak whales infrequently use the area. The shelf-break areas are especially used by nonendangered cetaceans for feeding during the summer. All these areas would be exposed to the spill as previously described for endangered cetaceans. The effects are expected to be quite similar to those described for endangered whales. Effects may include skin contact, avoidance of patches of thick oil, baleen fouling (for the minke whale only), inhalation of hydrocarbon vapors, a localized reduction in food resources, the consumption of some oil-contaminated prey items, and a temporary displacement from some feeding areas. A more detailed description of oil effects can be found in Sections IV.A and IV.D.1.a. However, due to the whales' ability to travel and forage over a large area and the apparent abundance of foraging habitat, this displacement likely would be a minor effect involving few individuals. The effect of a 1,000,000-bbl oil spill on nonendangered cetaceans is expected to result in some population change in abundance and/or distribution but the population would recover to its former status within one generation.

(5) Impact on Pinnipeds, Polar Bears and Sea Otters

The consequences of a 1,000,000-bbl oil spill near the Pribilof Islands potentially could be severe and long lasting if it occurred where large numbers of pinnipeds are concentrated in late summer. In the Pribilof Islands, the northern fur seal (designated as a depleted species under provisions of the Marine Mammal Protection Act) would be the species most vulnerable to oiling since the insulative effectiveness of their fur is destroyed by contact with oil. In addition, their widespread occurrence in pelagic waters in this area (during a lengthy breeding season) and a population that still may be declining also suggest that it would be extremely vulnerable to the oil spill. Harbor seal pups could be vulnerable if they become sufficiently oiled to disrupt recognition by their mothers. Adult and subadult harbor seals could experience adverse effects if heavily oiled, but the potential severity and likelihood of mortality is not well known. Polar bears rarely occur this far south even during the winter season; none would be present in late summer. An insignificant proportion of the regional sea otter population occupies the Pribilof Islands.

A spill at the location and of the magnitude postulated is very likely to incorporate the immediate vicinity of the Pribilof Islands (which are just 72 km apart) since it is estimated that this amount of oil would result in a discontinuous slick 1,743 km^2 in extent within 10 days (Table IV.H-2). In fact, the spill-trajectory model (Spaulding et al., 1988) suggests that the contact probability of oil with St. Paul Island released at the indicated spill point exceeds 60 percent and would potentially come ashore within hours. It is estimated that 100 percent of the Pribilof coastline could be oiled within a short time (Table IV.H-3), and the shoreline of Nunivak Island and the surrounding area would be contacted after 30 days. The spill is assumed to concentrate in the vicinity of the Pribilofs and to the east and northeast.

The discontinuous nature of any spill suggests that a certain, often substantial, proportion of the area covered actually is oil free at any particular instant; however, since spills are dynamically influenced by winds and currents, the area over which patches and streamers of oil sweep essentially becomes equal to the area likely to be covered by a discontinuous slick in a given period. This has important implications for pinnipeds, that frequently concentrate at traditional foraging areas where prey are abundant, in that a particular area occupied by successive groups or a constant procession of foragers may be contacted repeatedly by slicks from a large spill over a protracted interval, and thereby greatly increasing the numbers of animals potentially oiled. Likewise, individuals that return to the same foraging area repeatedly would risk multiple exposure from returning to the islands after each foraging trip, since the Pribilof coastline is 100 percent contacted. During the breeding, season most fur seals are concentrated within approximately 160 km of the Pribilof Islands, including the shelf break about 100 km distant, but also may forage as far as the eastern Aleutians. From 30 to 45 days after the spill, the area swept by the discontinuous slick would be sufficiently large (6,324-10,126 km^2) to incorporate all of the area between the islands and the shelf break (Table IV.H-2), although the slick is more likely to be found to the east or northeast, encompassing important foraging areas towards Unimak Pass and extending potentially as far as Nunivak Island. Harbor seals occupy the inshore zone that is likely to be heavily oiled.

Since fur seal densities near the Pribilof Islands and in intensively used foraging areas may be as high as 250/km^2, the potential exists for contacting up to several hundred thousand individuals. In addition, an average of 60 percent of these individuals may be lactating females whose pups would die if the females did not return or if the females transferred significant quantities of oil to them. The overall proportion of the population experiencing adverse effects evidently could exceed 25 percent. Preliminary results of a fur seal/oil-spill-interaction-simulation model (Applied Science Associates Inc., 1987) indicate that after a loss of 9 percent of the population (the model scenario) initial recovery could require about 11 years, or approximately 2 female fur seal generations. After approximately 30 years (6 female generations), the modeled population begins fluctuating around the new equilibrium population size. However, at this point, the population-age structure still may not have returned to the original composition. Losses of greater magnitude postulated here presumably would require greater periods for recovery, and these values could increase during periods of otherwise unfavorable circumstances; for example, the recent and possibly continuing fur seal population decline (Fowler, 1985a).

The local harbor seal population could experience substantial adverse effects from a potential large spill but it does not represent a sufficiently large proportion of the regional population for losses to be of great significance. Prior to commercial harvesting, sea otters inhabited the Pribilof Islands but apparently were exterminated by this activity. Subsequent efforts to establish a viable population apparently have failed (Jameson et al., 1982; Rotterman and Simon-Jackson, 1988).

(6) Impacts on Marine and Coastal Birds

The consequences of a 1,000,000-bbl oil spill near the Pribilof Islands potentially could be severe and long lasting if it occurred when large numbers of foraging birds, including parents accompanying flightless young, were concentrated in the vicinity of the nesting colonies in late summer. In the Pribilof Islands, alcids (murres, auklets, puffins) would be the group most vulnerable to oiling, since they spend much time on the sea surface and dive when foraging or to escape threatening situations; fulmars and black- and red-legged kittiwakes could become vulnerable if slicks reached the shelf break, approximately 100 km distant. Large shearwater flocks also occasionally are found along the shelf break in late summer and fall.

A spill at the location and of the magnitude postulated here is very likely to incorporate the immediate vicinity of the two Pribilof Islands (which are just 72 km apart) since it is estimated that this amount of oil would result in a discontinuous slick 1,743 km^2 in extent within 10 days (Table IV.H-2). It is estimated that 100 percent of the Pribilof coastline could be oiled within a short time (Table IV.H-3), and the shoreline of Nunivak Island and the surrounding area would be contacted after 30 days. Spill contact is assumed to concentrate in the vicinity of the Pribilofs and to the east and northeast.

The discontinuous nature of any spill suggests that a certain, often substantial, proportion of the area covered actually is oil free at any particular instant; however, since spills are dynamically influenced by winds and currents, the area over which patches and streamers of oil sweep essentially becomes equal to the area likely to be covered by a discontinuous slick in a given period. This has important implications for birds that frequently concentrate at traditional foraging areas where prey are abundant, in that a particular area occupied by successive flocks of foragers may be contacted repeatedly by slicks from a large spill over a protracted interval, and thereby greatly increasing the numbers of birds potentially oiled. Likewise, individuals that return to the same foraging area repeatedly would risk multiple exposure. During the breeding season, most of the vulnerable alcids are concentrated within approximately 50 km of the Pribilof Islands. In addition, the area northeast of St. George Island and east of St. Paul Island, approximately 100 km distant, appears to be a particularly critical foraging zone for murres (Hunt et al., 1981a). Fulmars and kittiwakes concentrate near the shelf break about 100 km south of the islands. From 30 to 45 days after the spill, the area swept by the discontinuous slick would be sufficiently large (6,324-10,126 km^2)to incorporate all of the area between the islands and the shelf break (Table IV.H-2) although the slick is more likely to be found to the east or northeast, encompassing the important murre foraging area and extending potentially as far as Nunivak Island.

Since densities in the vicinity of the Pribilof Islands range from approximately 200 to 500+ birds/km^2 in summer, mortality could range from 348,000 to 871,000 individuals, equivalent to 12 to 31 percent of the total population (15-37% if only alcids are considered; 19-47% if only murres). The principal effect of such substantial mortality would be to considerably lengthen the population recovery period. For example, Ford et al. (1982) estimated that a population of thick-billed murres experiencing a onetime, 25 percent mortality of all age classes could require 15 years for recovery to prespill levels. This is approximately the equivalent of 3 to 5 murre generations. Common murres could require 25 years for recovery from such a loss, equivalent to 5 to 8 generations. These values could increase during periods of otherwise unfavorable conditions (e.g. food scarcity, severe weather).

Oil contacting marine bird concentration areas in the Nunivak Island area could produce similar effects locally and add to the overall effects of a large oil spill. Emperor geese nesting on the island and other geese in migration along its coastline could be contacted by oil after 30 days, but numbers significantly affected are expected to be low. Although spill trajectories are assumed to not reach the Yukon-Kuskokwim Delta by 30 days, potentially they could if followed for longer periods and thereby placing at risk goose broods or migrants concentrated in the intertidal zone. However, if this would require substantially longer than 30 days, it is likely that the majority would have departed or passed through the area before oil made contact with the delta. Larger numbers of diving ducks, particularly eiders, oldsquaw, and scoters, are at risk in this area during August.

The effect of a 1,000,000-bbl spill on marine and coastal birds is expected to result in changes in population abundance and/or distribution requiring 3 or more generations to recover to its former status.

(7) Impacts on Fisheries Resources

A 1,000,000-bbl oil spill occurring near the Pribilof Islands, in August, could immediately contact the following adult and juvenile shellfish and finfish of economic value: blue king crab, *opilio* Tanner crab, Pacific halibut, and arrowtooth flounder. These species are representative of other species that occupy the benthos during most of their life histories, and presumably related species would be affected similarly to those analyzed here. Additional eastern Bering Sea shellfish and finfish would be contacted at later periods as some of the oil moved across the continental shelf break and toward the eastern Aleutian Islands. During August, eastern Bering Sea shellfish and finfish would have largely finished reproductive and early developmental activity in surficial/shallow pelagic waters and have assumed bathypelagic to benthic habitat well away from the early toxic effects of the oil.

BLUE KING CRAB: This benthic shellfish occurs within and adjacent to the area of the spill. The blue king crab may release larvae every other year and, during early benthic life, smaller blue king crab may require a specific and limited benthic habitat of cobble rock and shell hash substrate that is disparately distributed, mainly eastward of the Pribilof Islands. The effects of this spill on blue king crab would be both indirect and direct, the oil indirectly affecting the species by reducing its food supply, and directly by contacting the crab on its benthic habitat. Oil in water is distributed in its water-soluble fractions, as a surface slick, and later as a partially soluble mousse of oil and water. Later aggregations form tar balls that can sink to the ocean bottom. Table IV.H-4 does not show lethal to sublethal concentrations of dispersed oil in the water column to the point where it would affect the blue king crab. The NMFS studies summarized by Rice (1981) show that oil in concentrations of .1 to 2 ppm have lethal effects to Tanner crab larvae and in concentrations of 1 to 4 ppm on the adults of similar size and physiology. These same concentrations are roughly applicable to the blue king cab. Any tar balls or other insoluble materials would eventually sink to the ocean bottom and have the capability to contact blue king crab, their food supply, and their habitat. These vestiges of the spill would tend to be scattered, thus not blanketing any large area of the seafloor. The blue king crab inhabit the benthos, as does their food supply, where the concentrations of oil are below sublethal levels. If the concentrations of tar balls are discontinuous and widely dispersed, it may be concluded that a large oil spill near the Pribilofs, in August, would have little effect on blue king crab populations.

TANNER CRAB: The *opilio* Tanner crab species is also found within or adjacent to the area of the oil spill. This crab may release its larvae in conjunction with the early spring phytoplankton bloom (Somerton, 1982), and the pelagic larvae of this species will have assumed benthic juvenile existence by August. Effects on the *opilio* Tanner crab would be similar to those on the blue king crab, with only small, insoluble parts of the oil spill reaching the benthic habitat. As discussed, these volumes would be dispersed and discontinuous over a very large benthic area containing an also relatively large distribution of *opilio* Tanner crab. For example, after 60, days the area of the discontinuous spill would encompass about 14,143 km^2, which represents about 2 percent of the total distribution of this shellfish species (Somerton, 1982). The distribution of *opilio* Tanner crab is not uniform, yet its habitat and food requirements dictate a considerable spacing among themselves even though they are not colonial. The distribution of tar balls and other insoluble oil components is not uniform or concentrated; therefore, the number of crabs contacted would probably be less than 2 percent of the eastern Bering Sea population; an even lower percentage would sustain toxic effects.

GROUNDFISH: Pacific halibut, yellowfin, sole and a number of other flounder species are characterized as having early egg and larval stages in pelagic waters before assuming juvenile to adult life stages in the benthos. The arrowtooth flounder has bathypelagic eggs and larvae that enter the benthos from those waters. These groundfish, and others in this group, spawn during late spring and early summer months, with the concentrated spawning generally not in the area of the spill; subsequent spill movements do not contact these pelagic spawning areas. In August, virtually all larvae would be absent from areas contacted by the spill. In the absence of groundfish eggs and larvae, the effects of this spill would be mainly on the benthic juveniles and adults via direct contact, toxic effects to their food supply, and degradation of their habitat by insoluble or slightly soluble parts of the oil spill that sink to the ocean bottom. The NMFS trawl-survey data (Pereyra et al., 1976) do not show the immediate area of the oil spill as supporting large numbers of groundfish. Eastern Bering Sea groundfish range over virtually the entire eastern Bering Sea; however, seasonal and/or main concentrations are over the continental shelf and shelf break and into outer Bristol Bay. This constitutes an area estimate at no more than 20 percent of the total groundfish habitat—less than 150,000 km^2. After 60 days, the oil spill has spread to about 14,143 km^2 and has the potential to affect about 10 percent of the groundfish habitat.

PACIFIC HERRING: These small, pelagic fish occur throughout much of the eastern Bering Sea, migrating long distances from their overwintering areas to spawn in the nearshore waters of southwestern Alaska from Norton Sound to the north Alaska Peninsula, but mainly in Bristol Bay. Following spawning, herring remain in coastal waters until late summer when they return to overwintering areas northwest of the Pribilof Islands. An oil spill near the Pribilofs, in August, would have little or no potential to contact Pacific herring at this time.

PACIFIC SALMON: Straty (1981) does not show Pacific salmon as migrating near the Pribilofs either as spawning adults or migrating smolts. By August this group of fishes would be in nearshore waters or their spawning streams. This hypothetical oil spill would have no effect on Pacific salmon.

The effect of a 1,000,000-bbl oil spill on fisheries resources is expected to result in sublethal effects to individuals in a population but would not change population abundance or distribution.

(8) Impacts on Local Employment

Under the scenario, 1,000,000 bbl of oil are released 28 km due east of St. Paul Island. The oil would hit shore on St. Paul Island within hours of the spill. The oil would also hit St. George Island within 10 days and Nunivak Island before the end of day 30. Industry does not have the technology to clean up completely a spill of this magnitude, and, therefore, the potential is great for serious effects on St. Paul Island, and to a somewhat lesser extent on the economy of Unalaska.

On St. Paul Island, the subsistence economy depends on the fur seal harvest, halibut fishing, and birding and egging. All of these activities would be severely harmed by an oil spill with the magnitude of the one considered here. The loss of these resources would be a real loss in household income and would cause increased dependence on the cash economy. This loss of income could last for several years depending on how fast the resources recovered. A greater reliance on the cash economy could cause greater competition for jobs and result in declining wage rates; thus, exacerbating the declining real income.

In addition to a loss of subsistence income and the resulting pressures on the cash economy, the commercial fishing industry, as it relates to St. Paul, could be harmed. Currently, the community of St. Paul is encouraging the commercial fishing industry to use St. Paul as a service center for the Bering Sea fleet. In addition, the local village corporation is encouraging the local population to become more involved with the commercial harvest of halibut. An oil spill could harm species taken commercially or cause a reduction in demand for species due to the perception that species are tainted by oil; thus, reducing the catch and the number of fishermen in the area, and harming both local and nonlocal fishermen. A reduced catch or reduced demand for the catch in the vicinity of St. Paul would reduce the need to put in at St. Paul harbor for services and would, therefore, effect the service industry and the cannery. These events would reduce further the income of the community.

The effects, as described above could be partially offset by an increase in employment related to oil-spill cleanup. This, however, is expected to last only 1 year while the adverse effects are expected to last longer than 1 year.

Since the subsistence resources and the commercial fisheries in the vicinity of St. George Island will also be affected by the spill, the effects will be similar to those on St. Paul.

It is expected that the economy of Unalaska will also experience adverse effects as a result of a large oil spill. These affects could result from a reduction in species populations or reduced demand for Bering Sea species due to consumer perceptions; both of which would harm the commercial fishery. Unalaska is a regional service center for the commercial fishery and is also home to several canneries. Because of the economy's dependence on commercial fishing and the harm that an oil spill would have on this industry, it is expected that the oil spill described in this section would severely effect the economy of Unalaska. This is expected to be mitigated, somewhat, in the first year due to cleanup activities, but because the effects of the oil spill would be of a longer duration, this would not reduce the level of effects.

The effect of a 1,000,000-bbl oil spill on the economies of the Pribilof Islands and Unalaska is expected to result in important and sweeping changes in the economic well being of the residents.

(9) Impacts on Land Use Plans and Coastal Management

LAND USE PLANS: The effects on land use on St. Paul Island, resulting from a 1,000,000-bbl oil spill, are primarily associated with the following types of uses: (1) land requirements for the storage of oil-spill equipment and materials and (2) housing needs of oil-spill-cleanup personnel.

A spill of the magnitude assumed would require a significant amount of oil-spill-cleanup equipment and material. These materials would be transported to the cleanup sites through the St. Paul airport and harbor. The service base constructed at the airport to provide air-support facilities for Navarin Basin development would be the offloading point for equipment and personnel. The large amounts of cleanup equipment necessary would require additional onsite-storage areas and covered space. These facilities would probably be constructed adjacent to the air-support base or at harbor-area-siting locations. In addition, a staging area adjacent to the harbor would also be necessary. The construction of storage facilities for cleanup equipment would probably infringe on existing land uses adjacent to the airport and harbor for the duration of cleanup activities.

A spill of this magnitude would require a large number of cleanup personnel. Transient laborers seeking employment should be discouraged from traveling to the Pribilof Islands by the high cost of airfare. As a result, a large body of unemployed, nonlocal workers seeking employment on St. Paul would not occur. However, a large number of outside officials, technicians, and laborers would be on the island until cleanup activities terminated for the winter. This body of personnel would require lodging and support services. Because of the limited amount of lodging and support facilities on St. Paul, temporary facilities would have to be built or cleanup personnel could be housed onboard support ships. The effect of the assumed spill on land use on St. Paul Island is expected to result in activities that are incompatible with or displace a preferred land use.

COASTAL MANAGEMENT: Effects considered in this section are those that would follow a 1,000,000-bbl oil spill; therefore, potential conflicts with the ACMP associated with initial siting decisions are not pertinent. Many decisions following the spill would be made on an emergency basis, and therefore exempt from the normal decisionmaking process. However, support facilities and housing modules placed in St. Paul and Unalaska probably would be located in conformance with the ACMP. For example, support facilities probably would be constructed adjacent to the airport or the seaport. These areas have been identified in the St. Paul CMP for this purpose. Moreover, the St. Paul CMP indicates that temporary residences and offices may be located outside the development corridor (St. Paul CMP Policy 5 [d]), especially if they are constructed adjacent to or near existing development in the development corridor (St. Paul CMP Policy 4).

New structures should be connected to municipal utility services when a connection is available (St. Paul CMP Policy 17). Again, this is likely to occur if services are available. However, it is unclear if demands for water and for sewage disposal can be met for this temporary surge. Water supply is a concern on the island, but the demand could be satisfied by importing water or by desalinization. Sewage problems associated with transient persons seeking employment should not be a problem. It is unlikely that job seekers would descend upon St. Paul Island—travel to the island is expensive and the weather is not conducive to extended periods of camping. More likely, hiring would be done elsewhere, and the area of hiring would need to deal with the refuse and sewage problems generated by job seekers who do not have a place to live.

Oil or oiled sorbents brought to St. Paul for transshipment or disposal would be subject to the St. Paul CMP requirement that the mayor or city manager be notified of this activity directly by the ADEC and that the materials be disposed in conformance with State and Federal requirements (St. Paul CMP Policies 37 and 38). There should be no conflict with these requirements.

All the statewide standards and district policies relating to effects from an oil spill are applicable for this analysis. These include statewide standards and district policies for subsistence; habitats; and air, land, and water quality. In addition to these, the Cenaliulriit policies and those from all district programs that pertain to commercial fishing may be applicable. The residents of Cenaliulriit would be affected by this unlikely event. The CCMP has local standards that address some of the potential psychological and social implications of a major local cleanup effort. For example, it is determined that oil reaching the delta should be removed; those involved would need to be sensitive to the "Yupik way of life" and take measures to "minimize disruptive cultural contact" if the work attracts "a substantial number of non-Yupik to a traditional Yupik village" (CCMP 2.1 and 3.1).

The statewide standard for offshore habitats identifies fishing as a primary use of the offshore area. In the event of a 1,000,000-bbl spill, this standard would not be met. The Aleutians East CRSA developed more specific policies to ensure the viability of commercial fishing. For example, commercial fishing interests must be notified "of the schedule and location of potential conflicts or physical obstructions which may impact or preclude commercial fishing opportunities or damage/contaminate fishing gear" (AECMP D-5.2). In nearshore areas identified as Special Habitat Policy Areas, policies often restrict activities that would preclude or significantly interfere with commercial fishing activities. However, none of the commercial fishing operations within the Aleutians East district should be restricted as a result of this spill (see Section IV.D.1.a(11)) and the primary potential conflict would be with the statewide standard for offshore habitat.

(10) Impacts on Sociocultural Systems

It is assumed that the subsistence fur seal harvest has been completed by the time of the spill in August. The annual subsistence fur seal harvest normally takes place between the end of June and August 8. The tour groups organized through the Tanadgusix (St. Paul village) Corporation, which constitute the other major activity on the island at that time of the year, should be filling the King Eider Hotel. Assuming no significant stockpile of oil-spill-cleanup equipment and materials exist on the island, the harbor and airport on St. Paul are assumed to be used to transport equipment, materials, supplies, and personnel to the spill site. (Even if there were a stockpile on the island, the equipment is assumed insufficient to cope with the magnitude of the spill.) The airport is assumed to be the primary avenue for transporting cleanup equipment to St. Paul Island during the early stages of the spill since an inundation of the island by oil would make use of the harbor dangerous to the personnel and property involved. Given a lesser amount of oil affecting St. George Island, it is possible that the harbor on St. George Island could be used to offload waterborne equipment and materials. These materials could then be transported to St. Paul Island by barges or helicopters.

The size of the spill and the international importance of the resources on the islands suggest that St. Paul Island can be expected to be invaded by an international community of print and television journalists, photographers, and animal welfare followers. Transient laborers would be discouraged by the cost of the air fare from traveling to the spill site to seek work, but there could be a considerable body of outside officials, technicians, and laborers on the island at least until winter stalls cleanup efforts (possibly in October or November). It is assumed that the number of such individuals that might be on the island at any one time could range from 50 to 500. An extensive use of local personnel, equipment (such as trucks, buses, and other mechanical equipment), and facilities (such as covered space for housing, storage, command center, etc.) from the island is also assumed.

As the oil-spill-cleanup event evolves, jobs should be made available for everyone living on the island willing and able to work. If jobs are not made available, this could be disruptive in itself, since residents likely would want to mobilize cleanup efforts anyway—doing this while others are being paid for their labor. Assuming local hire practices are used, however, this would provide an immediate source of disposable income for those participating in the cleanup, but could cause discord with those that choose not to participate in the cleanup. The intermingling of local and outside cleanup workers and the availability of disposable cash for recreational pursuits could produce a socially unstable environment in St. Paul and St. George. Other aspects of the cleanup event that could contribute to the disruption of sociocultural systems on the islands would include the irritability and possible sickness and depression caused by the stench of oil permeating living spaces 24 hours a day; the threat of fire in the early stages of the spill, especially at the St. Paul harbor; the congestion and limitation of space on aircraft at the airfield; the possible loss of income from being unable to commercially fish for halibut; the intense level of activity on the islands as a result of cleanup efforts; the need to deal with trespass issues (over Tanadgusix Corporation lands) in the initial stages of organizing the cleanup effort; and the approach used by the agents for the spiller in attempting to compensate local residents for losses of resources and livelihood.

Despite these disruptive agents and the effects realized to subsistence, the chronic disruptive environment that envelopes the islands during and following cleanup should not persist much beyond 1 to 2 years and should not cause displacement of existing institutions that establish norms of social organization and community values. The Church, family-oriented social organizations, economy, and subsistence of the communities on the Pribilof Islands should remain intact long after the spill event, yet it would remain in the memories of the islanders for some time to come.

Effects on the sociocultural systems of Unalaska should not be as pronounced, since transshipment of equipment and materials is a normal part of the community's economy and should take place during only a relatively short period of time. The same should be the case for the walrus hunters of Gambell and Savoonga on St. Lawrence Island. Effects on island subsistence from the spill should produce only periodic disruption to sociocultural systems during the year of the spill but not cause restructuring social organization or cultural values. In the Yukon-Kuskokwim Delta region, effects on sociocultural systems could be more pronounced because of the potential 1 to 2 year duration of effects to their subsistence; likewise, these effects would not produce a threat of restructuring social organization or cultural values. Effects could include increased social discord and conflict brought about by feelings of depression over an event that confirmed closely held fears of major oil spill. The presence of remnant oil in the tundra would be a lingering reminder of events occurring around them that were much beyond their ability to control.

The effect of a 1,000,000-bbl oil spill on sociocultural systems is expected to result in chronic disruptions for a period of 1 to 2 years without displacement of the existing institutions. Unalaska and St. Lawrence Island would also experience periodic disruption of the sociocultural systems for a period of up to 1 year.

(11) Impacts on Commercial Fishing Industry

A 1,000,000-bbl oil spill near the Pribilof Islands in August would cause damage to the commercial fishing industry from: (1) lost fishing area and time; (2) oil-fouled fishing gear (pots, lines, buoys, longlines, and trawls); and (3) oil-tainted catch (or dollar loss even if catch is only perceived to be oiled). During August, pot fisheries often commence for king and Tanner crab, while trawl and smaller scale Pribilof Island longline fisheries for halibut and cod remain in progress.

At this time, the following pot fisheries for shellfish are operative in the eastern Bering Sea: (l) red king crab; (2) blue king crab; (3) *opilio* and *bairdi* Tanner crab; and (4) brown king crab. In recent years, declines in eastern Bering Sea shellfish stocks, primarily the red and blue king crab and *bairdi* Tanner crab, have led to reduced quotas and/or closed areas. The area immediate to the Pribilofs that once supported a commercial fishery for blue king crab is presently closed due to depletion of the population which may be due in part to overfishing. An August oil spill could force closure of the *opilio* Tanner crab fishery and the longline fishery for halibut. The recent oil spill in Prince William Sound did not force closure of the halibut fishery in nearby ocean waters. Presumably, this open-ocean spill would dissipate more rapidly and have a lesser effect on the longline gear used in these fisheries.

The red king crab fishery is a Bristol Bay fishery located in the outer waters along the north Alaska Peninsula from about Cape Seniavin to Nelson Lagoon. Managed on a guideline harvest level, the September season usually achieves the current harvest level of 16.5 million lb (plus or minus 5 million lb) in a matter of a few days. The Bristol Bay red crab fishery would not be contacted by the spill within 30 days.

The blue king crab fishery is now largely conducted near St. Matthew Island. This pot fishery also operates on a quota or guideline harvest basis; the annual current quota of 600,000 to 1,300,000 lbs. is usually harvested in less than a month. The 1987 season lasted only 4 days. The blue king crab fishery off the Pribilofs, was closed in 1988 and is not anticipated to resume in 1989. The immediate direct effects on the blue king crab fishery from this assumed spill would not occur.

The brown king crab, a deep water species, is presently sought on a limited scale, generally when other crab seasons are closed. The fishery usually occurs in the deep waters beyond the shelf break. Oil-spill-risk-analysis data do not show the oil spill moving into areas where brown king crab are fished (beyond the shelf break).

The *bairdi* Tanner crab fishery also occurs beyond the reach of this oil spill, north of the Alaska Peninsula, but south of the Pribilof Islands. The spill apparently would have no effect on pot fisheries for red, blue, or brown king crab, or the *bairdi* tanner crab.

The *opilio* Tanner Crab, presently widely fished in the eastern Bering Sea inhabits areas that might be contacted by this oil spill and in these areas the gear employed for harvest could also be expected to be contacted; thus affecting the commercial fisherman. In 1986-87, a total of about 102 million lb of *opilio* (with a value of $280 million) was harvested from eastern Bering Sea waters. If the oil spill occurred, the loss to the fishermen would then be about this amount if fishing were prohibited—a likely decision, based on events from the Prince William Sound oil spill. The value of pot gear, including buoys, varies; the cost of a newly fabricated crab pot has been quoted at about 450 to 500 dollars (Ramos, pers. comm., 1989). While not totally lost by oil contamination, the pot would need to be cleaned and the cordage replaced. With vessels deploying up to 500 pots (Griffin, 1985), the loss could be substantial even if only a few pots were contaminated. The oil spill while not contacting the opilio tanner crab fishery in August, could affect the fishery in September and October.

Eastern Bering Sea trawl fisheries are all domestic, with some joint-ventures where American trawlers deliver their catch to foreign, floating-processing vessels. Lesser amounts of the total trawl harvest are processed aboard American catcher-processor vessels or are delivered to shore-base processing plants.

Trawl fisheries harvest a variety of groundfish but target largely on walleye pollock, Pacific cod, and the yellowfin sole. A trawl and catch could be contaminated by contact with oil. Oil in a trawl-fished area would also prevent further trawling.

Trawlers operate over much of the eastern Bering Sea, but fishing concentrates along the continental shelf break just north of Unimak Pass and for yellowfin sole extends into Bristol Bay. Some trawlers operate year-round although harvest quotas for some species may cause termination after the quota is reached. A more comprehensive discussion of eastern Bering Sea commercial fisheries is found in Section III.B.3. A 1,000,000-bbl spill near the Pribilof Islands, in August, would not immediately contact the fishery nor would it force immediate cessation of trawling in adjacent areas. The oil soon would reach trawled areas and would probably cause fishing to stop to prevent gear and catch contamination. The duration of the stoppage would probably exceed 30 days. The North Pacific Fisheries Management Council, the principal fisheries management agency for the eastern Bering Sea trawl fishery, would make the regulatory decisions. Even a small loss of relatively expensive trawl gear and/or catch would have a severe effect on the individual trawler since the large volume of fish per trawl could be of high economic value. An oil spill that contacted trawl gear, harvest, or fishing areas could severely curtail the operation. This size spill would probably contact a large segment of the fishery.

Aside from the pot, longline, and trawl fisheries for shellfish and groundfish, there also are inshore-commercial and subsistence fisheries for salmon and herring. An oil spill in August near the Pribilof Islands would not contact the herring fishery, which would have ceased by this time, nor the salmon fisheries, which are beyond the reach of the spill and that also have largely ended their seasons. An oil spill in the eastern Bering Sea might, however, have a perceived effect on the marketing of these species.

Bering Sea commercial pot fisheries would be affected by this oil spill chiefly through contact with areas where opilio Tanner crab occur. It would not affect pot fisheries for red king crab in Bristol Bay, the blue king crab fishery off St. Matthew Island, or *opilio* and *bairdi* Tanner crab fisheries beyond the immediate vicinity of the spill. The spill would not immediately contact the trawl fishery or force immediate cessation of trawling in adjacent waters. Oil would eventually reach trawled areas and fishing would probably be stopped to prevent gear and catch contamination.

The effect of a 1,000,000-bbl oil spill near the Pribilof Islands on the commercial fishing industry would result in frequent disruptions to the commercial fishing industry including gear loss or damage, foreclosed fishing areas or docking areas during the life of the project, and measurable economic costs to the fishing industry.

(12) Impacts on Subsistence-Harvest Patterns

Effects on subsistence-harvest patterns on the Pribilof Islands are expected to result from the effects of crude oil on subsistence resources and the timing of subsistence harvests. Potential effects to subsistence harvests are not expected to occur from the workers temporarily living on the islands for the cleanup effort, since they will be without families and subject to the same nonlocal conditions regarding the accessibility and availability of resources discussed under the proposal.

As a result of people being involved in shipping cleanup materials and equipment through Dutch Harbor to the Pribilof Islands spill site, effects on subsistence harvests in Unalaska should not produce a significant change to the subsistence-harvest patterns of that community, since transshipment is a normal part of the community's economy and should take place during only a relatively short period of time.

On the Pribilof Islands, the subsistence fur seal harvest is assumed to be completed before the August spill. (By statute, the annual subsistence harvest must be completed by August 8, being extended only if sufficiently justified and approved. A proposal is expected to be published to delete the extension option [54 *FR* 23235].) Subsistence halibut fishing would be underway as the spill hit, and probably would be terminated for that year. Commercial halibut fishing, being a longline operation rather than one using nets, could possibly be carried on during the winter months if the oil had sufficiently dissipated. Subsistence birding and egging likely would not be carried on because of the vast die off of marine and coastal birds, the effect of the spill on nesting, and the possible concern for egg contamination. Collection of intertidal resources would be terminated for at least that year, with the spill having inundated all reaches of the islands. The hunting of marine mammals would be curtailed during the duration of the spill, and probably would be limited thereafter if there were concern on the islands about the health or contamination of such mammals.

In contrast to the other cases considered, the tanker spill here is instantaneous and potentially inundates St. George as well as St. Paul Island. Under this condition, it would not be possible for subsistence resources to be selectively interchanged between the island communities. Therefore, in the short term, subsistence harvests would be expected to be wiped out where marine and intertidal resources were concerned. Available resources would either be destroyed or damaged, or feared to be used by local residents. In the long term, the level of effects on subsistence-resource harvests would depend on the length of time such conditions prevailed. This is underscored by the potential biological effects levels associated with marine mammals, especially for fur seal, sea lion, and harbor seal, which are mainstays of subsistence on the islands.

Walrus, in their annual northern migration, could likely be affected by the oil spill, but St. Lawrence Island residents would still be expected to acquire at least a measure of their annual walrus catch. Effects on walrus harvests should not last beyond the year the spill occurred. On Nunivak Island, 30 days after the spill oil remnants are assumed to contact the south coast where seabird colonies and other marine resources could be affected. Considering the *Exxon Valdez* experience, if oil residue could be expected to remain in the water column well after 30 days, then oiling could be expected within the Yukon-Kuskokwim Delta region generally and possibly in regions further north. This would represent a continuation of the northeasterly direction expressed in the oil spill model. Nesting waterfowl and migratory birds, especially coastal breeding geese, could be effected if oiled by storm-driven flooding or by foraging birds returning to their nests. In the case of coastal or migratory bird populations, however, a reduction in the availability or desirability for use of coastal or migratory birds and their eggs would last at least the year of the spill and possibly extend for several years thereafter. Other subsistence resources also could be affected, especially the herring that spawn off Nunivak and Nelson Islands. The spawn and the subsistence herring harvest for that year would have been completed by the time remnant oil reached this area, but the roe-on-kelp herring offspring could be affected directly or indirectly if the kelp were not able to rejuvenate in subsequent years. According to Pete (1984), more than 100 metric tons of herring are taken yearly for subsistence purposes by the nine communities on Nelson Island. Those communities without access to salmon and without established bartering obligations would be especially effected by a reduction in availability or in desirability for use of herring. Effects on herring could have substantial material and social consequences because of its use as a winter staple in the subsistence diet of several communities locally and as a well-used resource in many other communities in the region.

A 1,000,000-bbl oil spill affecting the Pribilof Islands would result in one or more important subsistence resources becoming unavailable, undesirable for use, or available in greatly reduced numbers for the Pribilofs and its sharing network communities of western Alaska. This is expected to last from 2 to 5 years. St. Lawrence Island is expected to experience the same effects, but only for a period of 1 year. Unalaska would have subsistence resources effected for up to a year, but none would become unavailable. Other parts of western Alaska would experience periodic effects on subsistence resources, but with no overall effect on the total subsistence harvest.

(13) Impacts on Archaeological Resources

The Navarin Basin area does not contain any blocks located over significant landforms which could perhaps contain archaeological sites. Even if prehistoric resources existed in the area, the survival of these resources in potentially undisturbed sediments is unlikely. There are some areas of possible ancient human habitation around the Pribilof Islands. These offshore archaeological resources would only be affected by oil distributed in the water column which reaches the bottom and contacts the resources. This appears unlikely considering the water depths of the area (about 100-2,000 m) and around the Pribilof Islands.

Oil from the hypothetical spill could adversely affect onshore archaeological resources and shipwrecks. St. Paul and St. George would likely be contacted by 65 percent and 1 percent of the oil remaining after 10 days, respectively. Historic sites such as bird rookeries and sealing grounds would be oiled resulting in diminished value as historic sites. Previous experience during such spills requires the cleanup procedures to include Federal and State consultation prior to beach cleanup with concurrence on acceptable cleanup procedures. Archaeological resources may be significantly altered by cleanup activities. The effect of the spill on archaeological resources is expected to result in the loss of some unique archeological information.

3. Pacific Region

a. Introduction

Since there have not been any 100,000 bbl spills in the Pacific region as a result of OCS oil and gas operations, it was determined that tanker transportation would offer the most reasonable opportunity for a spill of this magnitude. Therefore, the spill is assumed to occur as a result of an Alaskan tanker accident in the vessel traffic lane in the southern Santa Maria Basin. A spill of 100,000 bbl occurs approximately 25 miles offshore southern California between Point Arguello and Point Conception.

b. Assumptions

It is assumed that approximately 100,000 bbl of crude oil is released within a 24 hour period. Offshore conditions (visibility) are such that cleanup activities are constrained. However, sea state is relatively calm resulting in the slick remaining relatively intact and spreading occurs.

Contact with the shore and sensitive offshore habitats is assumed to occur over a 30-day period. Information taken from the final EIS for the San Miguel Project, URS Corporation (1986) indicates that winds and currents during the months of June, July, and August would tend to drive the spill toward the east, southeast and south (winds from northwest at 14-16 knots and current toward south-southeast at .5 knots). Based on information taken from Ford (1985) a 100,000 bbl spill in this general area (35°N latitude) has a 50 percent probability of affecting approximately 75 km of coastline. Generally this would mean that the area from Point Sal in the north, to San Miguel Island in the south would be contacted. Although some of the nearshore area within the Santa Barbara Channel could be affected near the western end, it is unlikely that large segments would be contacted.

The spill is assumed to contact the mainland shore east-southeast of the spill in approximately 24 hours. Shoreline contact to the north and south would occur as the spill continued to spread. Within 72 hours oil reaches San Miguel Island and portions of the northern Santa Barbara Channel coastline.

c. Environmental Consequences

(1) Impacts on Water Quality

MARINE WATER QUALITY: The oil spill in this scenario is assumed to occur from a tanker within 40 km (25 miles) of the coastline off Point Arguello. A slick is assumed to be formed at the surface of the water over the discharge site, and the majority of the floating oil is assumed to be pushed to the southeast. Part of this slick is assumed to contact the mainland coast between Point Arguello and Point Conception within 24 hours. Within 3 to 5 days, oil is assumed to contact the mainland shoreline as far north as Point Sal and to reach the northern shorelines of San Miguel Island and the western half of Santa Rosa Island.

Section IV.A discusses the generic impacts of accidental oil spills on water quality. Degradation of offshore water quality is directly proportional to the areal coverage of the surface slick, and the concentration and residence time of the oil transported into the water column. A gradation of severity of impact on water quality would likely result, starting close to the source of the spill and spreading outward spatially and temporally. Based on estimates of median oil slick sizes presented in Ford (1985a), it is expected that these effects will be felt over an area of 3,000 km^2 or less. In the open ocean and in moderate to high seas, the spill would be rapidly dispersed and weathered by physical and biological processes such as evaporation, oxidation, emulsification, and uptake and metabolism by marine organisms. In areas contacted directly by a spill, before weathering had been completed, parameters such as oil and grease, trace metals, dissolved oxygen, hydrocarbons, BOD, turbidity, and most others would change by several orders of magnitude. Hydrocarbon levels within the affected areas are expected to be elevated up to 100+ug/l (Fiest and Boehm, 1980).

Concentrations of hydrocarbons in the water column surrounding the discharge point decrease with distance away from the spill, and would likely decrease tenfold for approximately 10 km on either side of the plume. Extrapolating from conditions recorded during the *Ixtoc* spill (Fiest and Boehm, 1980), it is assumed that the majority of the oil dispersed into the water column would occupy the upper 6 m.

Following a spill, the more volatile compounds in the slick, particularly aromatic hydrocarbons, would decrease significantly through evaporation over a period of days (Neff, 1990). High dissolution rates of aromatics from a slick, and accumulation in the underlying water, occur in the first few hours of a spill. About 5 percent of a slick can be expected to dissolve over the first 10 days of a spill (Butler et al., 1976). By the time dissolved oil has worked down 10 m into the water column, it is diluted and spread horizontally about 10,000 m. The slick becomes patchy, with a total area containing widely scattered patches of oil several orders of magnitude larger than the actual area covered by oil. Horizontal advection changes the water under the slick continuously, and aromatics do not continue to accumulate in the same water. As the processes of mixing and dilution continued, hydrocarbon quantities within the primary area of contact would be reduced to background levels after several weeks. Water uses are expected to be affected for up to several weeks near the source of the spill.

After the slick disappeared (after about 60 days), the spilled oil would persist as tarballs and tar particles suspended in the water column. Slow photo-oxidation and biological degradation would continue to slowly decrease the residual amount of oil. Through 1,000 days, about 15 percent of the tarballs would sink, with an additional 20-percent slick mass persisting in the tarballs (Butler et al., 1976). Because of the drift of oil over hundreds of kilometers during the slow process of sinking, individual, sunken tarballs would be widely dispersed in the sediments.

ESTUARINE AND NEARSHORE WATER QUALITY: It is assumed that the spill will spread out along the shoreline. Nearshore water quality would be affected by the oil due to backwashing of the oil into the surf zone. Oil returning to the surf would likely be trapped by longshore currents and would remain within nearshore waters, where it would become entrained in suspended particles and bottom sediments. Surf conditions would accelerate the amount of hydrocarbons dispersed into the shallow water column. Therefore, in nearshore waters contacting the beaches, it is expected that hydrocarbon levels would be significantly higher than background levels. This contamination would continue until the oil on the beaches is removed. Beach cleanup is assumed to be completed in about 6 weeks. Contaminated water that remains after the beaches are cleaned would mix with surrounding water and become diluted to background levels within several weeks.

The two stream mouths most likely to be contacted by this spill, the Santa Ynez River and San Antonio Creek, are closed due to lack of flow during most summers. Therefore, it is assumed that these estuaries would not be contacted by oil from this spill.

The 100,000-bbl spill assumed to occur under this scenario will degrade marine and nearshore water quality over an area of approximately 3,000 km^2 for a period of weeks. Hydrocarbon levels within the affected areas are expected to be elevated up to 100+ ug/l. Estuarine waters will not be affected. Water uses are expected to be affected for up to several weeks in and near the spill slick.

(2) Impacts on Air Quality

Following the spill, the more volatile compounds in the slick, particularly aromatic hydrocarbons, would decrease significantly through evaporation over a period of days (Neff, 1990). High dissolution rates of aromatics from a slick, and accumulation in the underlying water, occur in the first few hours of a spill. About 5 percent of a slick can be expected to dissolve over the first 10 days of a spill (Butler et al., 1976). Depending on the composition of the crude oil, total hydrocarbon emissions during the first hour would be approximately 57 lbs/bbl, decreasing to 29 lbs/bbl in the second hour.

An event such as this would result in short-term exceedance of the onshore air quality standard in the vicinity of the spill for the duration of the spill. However, onshore effects are highly dependent on the distance offshore, and weather conditions at the time of the spill. Since the spill is assumed to occur approximately 25 miles from shore during the summer when winds are predominantly from the northwest it is expected that short term exceedances of onshore standards would occur in the northern Channel Islands area and the onshore areas contacted during the first 24 hours. However, it would be unlikely to have long term, measurable effects on onshore air quality.

(3) Impacts on Threatened or Endangered Marine Mammals

The 100,000-bbl spill in this scenario is assumed to affect waters in the Santa Maria Basin and western Santa Barbara Channel from Point Sal to the northern Channel Islands, producing a discontinuous slick over an area of up to 3,000 km^2. The following threatened and endangered marine mammal species and their habitats could be affected by this spill: blue, fin, gray, sei, Bryde's, humpback, right, and sperm whales; Guadalupe fur seals; Steller sea lions; and California sea otters.

Blue and fin whales are the most abundant of the endangered baleen whales in the Southern California Bight (SCB) in the summer and the most likely to be contacted by the oil spill assumed to occur in this scenario. Numbers of both these species in the SCB are estimated to peak in the summer at 50 to 70 animals as they migrate northward along the continental slope; individual blue whales may remain around San Miguel Island for several weeks during this period (Dohl et al., 1981; Leatherwood et al., 1982; Bonnell and Dailey, 1990).

The remaining endangered cetaceans known to occur in the SCB are much less likely to be contacted by oil from the assumed spill. Gray whales are on their Alaskan feeding grounds during the summer. Sei whales probably follow a similar migratory pathway to blue and fin whales, but are uncommon in southern California waters. The closely related Bryde's whales are more tropical in distribution and are probably only occasional visitors to the SCB. Humpback whales, which migrate through the SCB in the spring and fall, apparently have no summer resident population in the area, although a few individuals have been sighted in the Santa Barbara Channel during these months. Northern right whales are very rare and have only been seen in the SCB twice during this century. Lastly, sperm whales, the only endangered odontocete in the area, are abundant offshore California, but are rare over the continental shelf where this spill is assumed to occur.

A generic discussion of the possible impacts of accidental oil spills on marine mammals is presented in section IV.A. Cetaceans risk a number of toxic effects from accidental oil spills at sea, including skin and eye irritation, lung damage from the inhalation of hydrocarbon vapors, internal tissue damage from oil ingestion, temporary baleen fouling, localized food reduction or contamination, and possible temporary displacement from preferred habitats or migration routes to the oil or to noise and disturbance associated with cleanup efforts (Geraci, 1990).

Given the low densities of endangered cetaceans, including blue and fin whales, in the affected area during the summer and the abundance of available habitats, only a few individuals are expected to come in contact with the spill. Effects are expected to be sublethal and to include primarily skin and eye irritation and displacement from the area of the spill for several weeks.

Since Guadalupe fur seals breed in the summer, most of the population is expected to be on or near the species' rookery on Isla de Guadalupe off Baja California at this time of the year. However, a few fur seals, mostly subadult and adult males, have been sighted on San Miguel and San Nicolas Islands in the summer (Stewart, 1981; Stewart et al., 1987), and a small, undetermined number of Guadalupe fur seals are probably present in area waters at any one time.

Like northern fur seals, Guadalupe fur seals depend on their dense underfur for insulation and thus are very vulnerable to the thermal effects of oiling (see Section IV.A); it is assumed that individual fur seals that came into contact with the spill would become fouled and die. Given the very low numbers of Guadalupe fur seals assumed to be present in the area, no more than 5 animals would be expected to die as a result of this spill. This level of mortality would not be distinguishable from natural variation within the species' population.

Steller sea lions are presently uncommon in southern California waters (Bonnell and Dailey, 1990). A few adult or subadult males may occupy territories on relict rookeries at the west end of San Miguel Island and adjacent rocks in the summer months, but the last reported pups on San Miguel Island were seen in the summer of 1980 (Stewart, 1980; Bonnell and Dailey, 1990). North of Point Conception, a few animals have been sighted in recent years on offshore rocks at Point Sal (Bonnell et al., 1983). The spill assumed to occur under this scenario is expected to have no measurable effect on Steller sea lions.

Although the bulk of the California sea otter population is found north of the Santa Maria River mouth (R. Jameson, FWS, pers. comm., January 17, 1991b), a few animals (probably less than 20) also occur between the river and Point Conception. Contact to the shoreline and nearshore waters south of Point Sal by the oil spill assumed to occur under this scenario would present a serious threat to those otters, and some mortality is expected to occur. It is assumed that the spill would not reach the small translocated sea otter population at San Nicolas Island.

As discussed in Section IV.A, sea otters are among the most sensitive marine mammals to the effects of oil contamination, and even a partial fouling of an otter's fur can result in death. Otters can also suffer effects from the inhalation of toxic fumes and the ingestion of oil (Williams, 1990), and less directly from a reduction in available food resources and loss of habitat (Riedman, 1987).

Up to 20 sea otters would be expected to die if the 100,000-bbl hypothetical spill occurred and contacted their habitat between Point Sal and Point Conception. This is roughly 1 percent of the California sea otter population, and recovery would take less than 3 years. Effective sea otter cleaning and rehabilitation would reduce this mortality.

The 100,000-bbl spill assumed to occur under this scenario is expected to result in lethal effects to two threatened and endangered species: California sea otters and Guadalupe fur seals. Up to 20 California sea otters could die (1% of the population); recovery would take less than 3 years. The minor Guadalupe fur seal mortality expected (no more than 5 individuals) would be indistinguishable from natural mortality within the species' population. Endangered cetaceans, primarily blue and fin whales, are expected to experience temporary, sublethal effects lasting for a period of several weeks.

(4) Impacts on Nonendangered Marine Mammals

The species of nonendangered marine mammals found in southern California waters that could be affected by this spill include four species of pinnipeds; one baleen whale; nine species of dolphins, porpoises, and small whales; and at least two species of beaked whales. A generic discussion of the possible impacts of accidental oil spills on marine mammals is presented in section IV.A.

Four species of nonendangered pinnipeds occur in the affected area during the summer: northern fur seals, California sea lions, harbor seals, and northern elephant seals.

An oil spill reaching the western end of San Miguel Island during the summer could contact the northern fur seal rookery. Northern fur seals breed at two locations on San Miguel Island: Adams Cove, a broad, sandy beach on the south side of Point Bennett at the western end of the island; and Castle Rock, a small island off the north side of Point Bennett. The population, which had peaked at over 3,600 animals on land in 1982, dropped to less than 1,500 during the El Niño year of 1983 . Although some recovery, to about 2,000 animals, was observed in 1984, there is evidence that the El Niño event might have had a long-term effect on pup production (Antonelis and DeLong, 1986; Bonnell and Dailey, 1990).

Foraging females from the San Miguel Island rookery are most commonly found in oceanic waters over the continental slope to the northwest of the island as far north as Point Sal (Bonnell et al., 1981; 1983; Antonelis et al., 1990). Since the oil slick from this spill is assumed to contact these waters, the potential exists for contact to hundreds of individuals. Mortality is likely to be high due to the fur seals' extreme sensitivity to the thermal effects of oiling (see Section IV.A). In addition, the vast majority of these individuals would be lactating females, whose pups would die if they did not return or if they transferred significant quantities of oil to them. Oil from this spill is also assumed to contact the Castle Rock rookery on the north side of the island, leading to the mortality of greater numbers of pups and females. It is assumed that the spill will not directly contact the Adams Cove rookery on the south side of Point Bennett.

The oil spill risk analysis model for marine mammals in the SCB developed by Ford (1985a, b) indicates that the greatest mortality for female and immature fur seals (23 percent) occurred when oil came ashore on the Castle Rock rookery in June. McLaren (1990) estimates that pinniped populations below equilibrium values could recover at rates of 7-18 percent per year and calculates that the time required for 95-percent recovery for a hypothetical pinniped population in which 23 percent, including equal proportions of all age classes, is killed is 6 years, or about 1 female fur seal generation.

California sea lions also breed on San Miguel Island during the summer. Several locations on Santa Rosa Island and Point Sal Rock on the mainland are used as hauling grounds by nonbreeding animals (Bonnell et al., 1981; 1983). In the summer of 1986, the California sea lion population on San Miguel Island contained 25,000 to 30,000 animals, including more than 12,000 pups (Boveng, 1988a; Bonnell and Dailey, 1990). Females from the San Miguel Island rookery forage primarily in relatively shallow waters over the continental shelf to the northwest and south of the island (Bonnell and Ford, 1987; Antonelis et al., 1990).

Unlike fur seals, adult California sea lions rely on a thick layer of subcutaneous fat for insulation, and oil has little effect on the relatively poor insulative capacity of sea lion pelts (Kooyman et al., 1976; 1977; St. Aubin, 1990). It is unlikely that any adult California sea lions would die as the result of this spill. However, newborn sea lion pups, which have little subcutaneous fat and are thought to rely greatly on their natal coat for insulation, are much more vulnerable to the thermoregulatory impacts of oiling. The oil spill model analysis conducted by Ford (1985a, b) indicates that the highest mortality estimated for female and immature California sea lions on San Miguel Island was 7.4 percent. Given a growth rate of 6 to 7 percent per year (Boveng, 1988c; Bonnell and Dailey, 1990), recovery of the population from such a loss is expected to take 3 years or less (Ford, 1985b; Neff, 1990).

Harbor seals are primarily coastal in distribution and occupy nearshore areas likely to be heavily oiled along both the mainland shoreline and the islands (Bonnell et al., 1981; Bonnell and Dailey, 1990). Pups are born in southern California from mid-February through mid-April, with a peak in March (Bartholomew and Boolootian, 1960; Stewart, 1988; Bonnell and Dailey, 1990). In June, 800 to 1,000 harbor seals have been observed hauled out along the stretch of mainland coast between Point Sal and Point Conception; another 1,100 to 1,200 harbor seals each have been found around San Miguel and Santa Rosa Islands (Hanan et al., 1988).

Harbor seals have been killed by oil, although large-scale mortality has not been observed (St. Aubin, 1990). Harbor seals are less vulnerable to the effects of direct oiling than species such as fur seals and sea otters, but newborn pups, which have less subcutaneous fat, may be more subject to thermal stress. Following the *Exxon Valdez* spill in Prince William Sound in March 1989, 31 oiled harbor seal carcasses were recovered; most of these animals were pups (D.G. Calkins 1979, cited in St. Aubin, 1990). Approximately 200 harbor seals were estimated to have been killed by the *Exxon Valdez* oil spill in Prince William Sound (Oil Spill Intelligence Report, April 11, 1991a).

Harbor seal population numbers along the section of southern California coastline expected to be contacted by the spill are lower than in Prince William Sound (Hoover, 1988). Pups would also be several months older and, therefore, less vulnerable to the thermal effects of oiling than had been harbor seal pups in Alaska (where the spill began about 1 month before the onset of pupping). Also, the 100,000-bbl spill assumed to occur under this scenario represents less than 40 percent of the oil spilled by the *Exxon Valdez* (Oil Spill Intelligence Report, March 28, 1991b). Thus, mortality resulting from this spill would probably be substantially lower. Although the exact level of mortality is impossible to predict, it is likely that fewer than 50 harbor seals would die as a result of this spill. This represents no more than 2 percent of the approximately 2,400 to 3,000 harbor seals found in the area from Point Sal to Santa Rosa Island. Given population growth rates equivalent to the 9 to 15 percent per year calculated for the California population for the years prior to 1986 (Boveng, 1988a), recovery would certainly take less than 3 years.

Only a small percentage of the northern elephant seal population, primarily large males ashore for their annual molt and a few juveniles, are present on land during the summer, while the remainder is dispersed at sea. A few thousand elephant seals are usually hauled out on San Miguel Island in midsummer. Like sea lions, adult and juvenile northern elephant seals rely on a thick layer of subcutaneous fat for insulation and appear to be little threatened by the thermal effects of oiling (St. Aubin, 1990). No measurable impacts on northern elephant seals are expected as a result of this spill.

Common dolphins, northern right whale dolphins, Pacific white-sided dolphins, Risso's dolphins, Dall's porpoises, Pacific bottlenose dolphins, short-finned pilot whales, killer whales, and minke whales are all common year-round residents or regular visitors to the area expected to be affected by this spill. Harbor porpoises are at the southern limits of their range in these waters, as are Baird's beaked whales. Cuvier's beaked whales are uncommon, but occasionally observed. Several other cetacean species, including beaked whales of the genus *Mesoplodon,* false killer whales, pygmy and dwarf sperm whales, dolphin species of the genus *Stenella,* and the rough-toothed dolphin, are rare in the Bight, and are known from the southern California area primarily from stranding records.

Cetaceans risk a number of toxic effects from accidental oil spills at sea, including skin and eye irritation, lung damage from the inhalation of hydrocarbon vapors, internal tissue damage from oil ingestion, temporary baleen fouling, localized food reduction or contamination, and possible temporary displacement from preferred habitats or migration routes to the oil or to noise and disturbance associated with cleanup efforts (Geraci, 1990).

However, given these species' abilities to move and forage over a large area and the abundance of habitat, the effects of this spill on nonendangered cetaceans are expected to be primarily sublethal, involving temporary displacement from the area affected by the spill for a period of weeks. Any mortality that does occur is expected to be minor (involving the deaths of a few individuals) and indistinguishable from natural population variation in the species affected.

The 100,000-bbl spill assumed to occur under this scenario is expected to have lethal effects on three species of nonendangered pinnipeds: northern fur seals, California sea lions, and harbor seals. Population recovery is expected to take 6 years for northern fur seals and 3 years or less for California sea lions and harbor seals. Impacts to nonendangered cetaceans are expected to include primarily sublethal effects lasting several weeks; any mortality will be indistinguishable from natural variation within the affected populations.

(5) Impacts on Threatened or Endangered Marine and Coastal Birds

BALD EAGLE: Bald eagles are not expected to be present in the assumed spill contact area during the summer months, and, therefore, this spill is not expected to have an effect on this species.

CALIFORNIA LEAST TERN: The months of June, July, and August, when the hypothetical spill is assumed to occur, overlap most of the California least tern breeding season, covering the period from egg laying, in some cases, to independence of the young. However, this spill is not expected to be a major threat to this species because there are only four very small breeding colonies in the assumed spill contact area. These colonies are located at Guadalupe Dunes, San Antonio Creek, Purisima Point, and the mouth of the Santa Inez River. Based on the proximity of these colonies to the assumed spill, the size of the spill, and assumed spill movement, all four of these colonies are expected to be lost as a result of spill contact. These colonies represent about 3 percent of California least tern breeding pairs, but because of the very slow population growth rate of this species and the expected total loss of these colonies, recovery may take up to 5 years.

CALIFORNIA BROWN PELICAN: During the summer months when the spill is assumed to occur, several thousand pairs of pelicans can be found nesting in the Channel Islands, mainly on Anacapa Island, which is part of the Channel Islands National Park, but also on Santa Barbara Island (another National Park island) and to a lesser extent, Los Coronado Island located in the Mexican portion of the SCB. The summer months are an important period for pelicans in the SCB. During this time, young pelicans leave the nest and begin learning to feed themselves. This period is also characterized by a large influx of birds (mostly immatures) from Mexico. The waters within 30 to 50 kilometers of a breeding island are of particular importance to pelicans for food supplies, especially when young are being fed (Anderson et al., 1980; Anderson and Mais, 1982).

Given the location, timing, and size of the spill, many hundreds to thousands of pelicans would be at risk of oil contact, and some mortality is expected to occur. Based on the assumed movement and spread of the spill, Anacapa Island is not expected to be contacted, although traces of highly weathered oil will probably occur around the island. However, as noted above many of the pelicans from Anacapa Island forage in the waters surrounding the other Channel Islands, including San Miguel Island, and these birds will be at risk from oil contact. Brown Pelicans also roost on the other Channel Islands, and on the mainland, particularly from Santa Barbara to Point Dume. The timing of pelican reproductive activities is highly variable, and young pelicans may not fledge in some years until mid- to late August. At least some reproductive losses are expected to result from this assumed spill, and depending on the exact timing of the spill, these losses could be severe. Based on these considerations, as many as 500 to 1,000 pelicans could be affected, with mortality of about 20 to 50 percent of affected birds. Although difficult to estimate, reproductive losses are expected, and overall recovery could require 1-4 years (depending on food availability during the recovery period).

LIGHT-FOOTED CLAPPER RAIL: Light-footed clapper rails are known to occur at only one or two locations in the assumed spill contact area, Goleta Slough and Carpinteria Marsh. During a 1980 census (Zembal and Massey, 1981a, b), no indication of clapper rail presence was noted for Goleta Slough, although two adults were sighted in this area in 1974 (Brad Schram, pers. obs. as cited in Zembal and Massey, 1981a, b). During the same census, 16 pairs were heard calling at Carpinteria Marsh, and 13 nests were found here. For this analysis, it is assumed that one or two pairs might occur at Goleta Slough and that the combined population of the two areas at risk represents no more than 10 percent of the total. Based on the spill scenario, oil is not assumed to contact the coastline in the vicinity of these two marshes for at least 72 hours. During the *American Trader* oil spill ofF Huntington Beach, two important marshes (Upper Newport and Bolsa Chico) were protected from oil contact through the use of equipment that is readily available along the southern California coast. It is therefore assumed that there exists sufficient time for protective booms and other measures to be deployed at these two critical areas, and therefore, this spill is not expected to have an impact on light-footed clapper rails. Nevertheless, if oil were to contact rail habitat, the impact on the population of these marshes could be severe (i.e., the loss of most breeding pairs). Due to the continued depressed population of this species, the loss of more than a few individuals could require up to 6-7 years for recovery, depending on the degree of habitat loss.

Based on the 100,000 bbl spill scenario, impacts are expected for two endangered bird species, the California least tern and California brown pelican. For the least tern, four colonies are expected to be affected by the spill representing about 3 percent of the total tern population, with recovery requiring up to 5 years. For the California brown pelican, as many as 500 to 1,000 pelicans are expected to be contacted with mortality of 20-50 percent of those contacted. Recovery is expected within 1-4 years, depending on food availability during the recovery period.

(6) Impacts on Nonendangered Marine and Coastal Birds

SEABIRDS: Although southern California is not noted for having large seabird populations as are other segments of the Pacific OCS Region or the Alaska Region, several species breed in the area and there is a sizeable migratory population. Summer is an extremely complex period for seabirds in southern California. During this period, seabird species can be found nesting on the Channel Islands, migrating through the area to their northern breeding grounds or during their return journey, visiting the area from their southern hemisphere breeding grounds. The Channel Islands are an important seabird nesting area. Eleven seabird species, including Cassin's auklets, western gulls, Brandt's cormorants, and ashy storm-petrels, nest on the Channel Islands, with about 60 percent of all individuals occurring on San Miguel Island. The waters surrounding the northern Channel Islands are particularly important to breeding species, while the most abundant seabirds during this period, sooty and pink-footed shearwaters, are summer visitors from the southern Hemisphere.

Based on the spill scenario, 10's of thousands of these seabirds would likely be killed due to oiling. The species most likely to be affected are: shearwaters, storm-petrels, cormorants, phalaropes, Cassin's Auklets, and gulls. Recovery periods vary with species and level of mortality but would range from 1 year for shearwaters to over 10 years for Cassin's auklets.

SHOREBIRDS: Common shorebird species along the southern California coastline include, willets, marbled godwits, sanderlings, and western and least sandpipers (Garrett and Dunn, 1981). The summer months when this 100,000 bbl oil spill is assumed to occur is a complex period for shorebirds in southern California. During this period shorebirds can be moving through southern California either northward to their breeding grounds (early June) or returning to their wintering grounds which includes southern California (August). Although in general shorebird populations are at their lowest level during this period, some species can be quite abundant, especially during August. Shorebirds appear to be less susceptible to oil contact than seabirds, although they are still vulnerable to the direct effects of oil contact as well as the indirect effects. Based on the assumed size, location, and timing of the spill, thousands of shorebirds could be at risk from oil effects with expected mortality of several hundred. Although species dependent, recovery is expected within 1-2 years because of the abundance and high reproductive potential of most shorebird species.

(7) Impacts on Fish Resources

In general, marine fish species are most vulnerable to a spill during the egg and larvae stages of their life cycle. Marine fish in southern California waters breed throughout the year, with preferred spawning seasons varying among species. As a result, fish eggs and larvae are present in the water column year round. Since the assumed spill will contact resources for one month of the year, the probability of a spill occurring at a point in time where it could affect a majority of fish species in the region is extremely unlikely. The species most affected by the spill would be those spawning at the time of the spill and those species that have just completed spawning. Once oil is removed from the water column, egg and larvae survival rates would return to pre-spill levels. The early life history stages of the important forage species anchovy and herring (spring spawners) and squid (winter spawners) would largely escape the most severe period of impacts from the large spill, since the most critical stages do not correlate with the spill.

Some local fish populations could experience sufficient egg and larvae mortality to result in a temporary population decrease, requiring at least one full breeding cycle to recover to its pre-spill size. On a regional level, the effects of spill on fish populations are expected to be inconsequential. Spill caused mortalities are expected to be indistinguishable from natural fluctuations of population numbers.

Because of their relatively high abundance in nearshore areas, fish such as white croaker and queenfish or the various species of rockfish could suffer local impacts limited to the area of contact, involving over 20 percent reductions of some of these species, with measurable (10-20%) indirect effects on trophically dependent species. Recovery would be expected to require 6 to 9 years for that segment of the population directly affected by the spill, but emigration would begin to fill population voids within a year.

Because of the widespread distribution of most fishes in southern California, the impact of spilled oil on fish populations would probably involve a 10 to 20 percent reduction in the population sizes of a few species (less than 10% of the number of species present) with no discernible indirect effects on trophically dependent species. Recovery from this disturbance to previous population levels is from 2 to 5 years. However, because of the relatively small area contacted in relation to the entire southern California area, impacts from the assumed spill would not be discernible from normal population fluctuations within southern California or the Pacific Region overall.

The 100,000-bbl oil spill would be expected to cause impacts on local populations of several near shore fishes limited to the area of contact, which would involve reductions of over 20 percent of some of these species, with measurable (10-20%) indirect effects on trophically dependent species. Recovery would be expected to require 6 to 9 years for the segment of the population directly affected by the spill, but emigration would begin to fill population voids within a year. Impacts would not be discernible from normal population fluctuations within southern California or the Pacific Region overall.

(8) Impacts on Migratory Fish

Two of the migrating fish species considered in this document, the steelhead trout and Pacific salmon, are anadromous with very sensitive stages in streams. The 100,000-bbl spill is assumed to occur during the summer when stream slow is greatly reduced to a yearly minimum. Potential spawning streams would be expected to be closed to the sea during summer because of the reduced stream flow. The two streams between Point Sal and the beginning of the Santa Barbara Channel at Point Conception are San Antanio and Santa Ynez Rivers, both of which are expected to be closed to the sea during the summer. Since the Channel Islands contain no estuaries, and the small Santa Maria River and Goleta Slough (by Santa Barbara) located north and south respectively of the assumed contact areas are the closest estuaries which may have small openings during at least part of the summer, no impacts during the spawning stages would occur from the spill. Impacts on the steelhead trout, Pacific salmon and Pacific whiting populations would, therefore, occur in offshore water.

Neither steelhead trout nor Pacific salmon have large populations in southern California, and reach their highest levels further north. Further, since both species are migratory with limited time in a given ocean area, the probability of being contacted by the oil spill for an extended period of time is very low. The spill, either offshore or coastal, would contact only a small portion of their pelagic habitat. Salmon and steelhead may be able to detect some hydrocarbons in the water and divert from these contaminated areas. Contact with the oil spill is expected to result in very low lethal or sublethal effects that would not be discernible from natural population level variations typical of southern California.

It is highly unlikely that the hypothetical oil spill in southern California would contact and impact a substantial portion of the early life stages of Pacific whiting, because whiting eggs and larvae are widely distributed throughout southern California, occur primarily offshore rather than in nearshore waters, and are most abundant at depths well below the water surface (approximately 50 m). Pelagic juvenile and adult whiting also occur throughout southern California and much of the Pacific region, but neither a substantial portion of the subpopulation nor its prey are likely to come into contact with the oil spill since they normally occur at depths well below the water surface (90-100 m in daytime to 20-40 m at night) and are widely dispersed offshore.

The 100,000-bbl oil spill would be expected to result in some lethal or sublethal effects that would not be discernible from natural variations of steelhead trout, Pacific salmon and Pacific whiting populations both locally and regionally.

(9) Impacts on Sea Turtles

Four species of sea turtles occur in southern California waters: the leatherback, green, loggerhead, and Pacific (or olive) ridley sea turtle. Although sea turtle populations in the Pacific Region are unknown, at-sea densities are certainly quite low. Leatherbacks are the most common of the four sea turtle species found in the Pacific OCS Region and the only one routinely sighted at sea (Dohl et al., 1983; Green et al., 1989).

Given the very low densities of sea turtles in this area, it is unlikely that any turtles would be contacted by the 100,000-bbl spill assumed to occur under this scenario, or that they would ingest oiled prey or tarballs. If mortality does occur, it is not expected to be distinguishable from natural variability within the species' populations.

(10) Impacts on Estuaries

Since the spill is assumed to occur during the summer when stream flow is greatly reduced to a yearly minimum, the two streams between Point Sal and the beginning of the Santa Barbara Channel at Point Conception, the San Antonio and Santa Ynez Rivers, are expected to be closed to the sea during the summer. Since the Channel Islands contain no estuaries, and the small Santa Maria River and Goleta Slough (by Santa Barbara) located north and south respectively of the assumed contact areas are the closest estuaries which may have small openings during at least part of the summer, no impacts on estuaries from the 100,000 bbl spill are expected to occur.

(11) Impacts on Coastal Habitats

INTERTIDAL BENTHOS: Although some of the nearshore area within the Santa Barbara Channel could be impacted by the assumed spill near the western end, it is unlikely that large segments would be contacted. From these assumptions, it follows that the spill would contact shore north of the Santa Barbara Channel mainland coast, which consists of approximately half rocky shore or San Miguel Island, which is essentially all rocky shore intertidal habitat. All the rocky intertidal areas are somewhat isolated from similar intertidal habitats and potential brood stock particularly for certain macroalgae with limited dispersal mechanisms. Further, the Point Sal and the Packard Point/Purisima Point areas are broad flat platforms which would remain covered by oil during lower tidal periods with smothering or toxic impacts for several days. The remaining Point Arguello/Point Conception area, in addition to partial isolation, having a large part comprised of flat platforms, is the dividing line between major biogeographical provinces and is the geographical end point of several species, some which are apparently endemic to the general area (USDOI, MMS, 1983b). Impacts from the assumed spill in these rocky intertidal areas could be as serious as anywhere on the Pacific coast. Large oil spills contacting these areas would cause noticeable mortality involving thousands of individuals and alteration of ecological relationships within the rocky intertidal community. Recovery could be retarded in some species for a year and different assemblages within the community could require 10 years to return to pre-spill conditions. Impacts to the sandy beach intertidal areas from the spill would involve smothering and immobilization of species such as the sand crab (*Emerita* sp.), beach hoppers (*Orchestoidea* sp.), and polychaete worms (such as *Euzonous* sp.). Recovery of the sandy beach biota from such a large spill during the summer and the relatively low wave energy characteristic of it, could require two years, regardless of the fact that most of the sandy beach communities contain fast-growing and highly mobile organisms that have adapted to the constant physically disturbed environment of shifting sands (ADL 1985; Chambers Group, Inc. 1986).

Impacts from the 100,000-bbl oil spill would be expected to involve noticeable mortality involving thousands of individuals and alteration of ecological relationships within the intertidal communities. Recovery could be retarded in some species for a year and different assemblages within the community would require 10 years to return to pre-spill conditions at rocky intertidal areas and 2 years at sandy beach areas.

SUBTIDAL BENTHOS: Rocky substrate features are relatively rare in the southern California area. They are widely scattered and often located in deep water. The diversity of their resident populations makes them a special resource in the Pacific OCS Region. Assuming hard bottoms are contacted by the spill, noticeable mortality, involving thousands of individuals, of the hard bottom community contacted could cause alterations of ecological relationships lasting for at least two years. Recovery would be slower and impacts higher if a species that has an important community function is destroyed on a particular rocky bottom substrate. The community may be altered until the population of the impacted species is replaced by brood stock from other areas. More serious impacts would almost certainly occur if the spill contacted shallow water hard bottom communities. The thousands of mortalities and ecological disruptions would require at least six years (species dependent) to recover. Impacts of this magnitude could have even longer lasting repercussions round the Channel Islands (San Miguel Island) since the islands are in the vicinity of a biogeographical transition area containing diverse flora and fauna, a few which may be endemic within the general area.

(12) Impacts on Employment and Demography

It is assumed that the occurrence of the 100,000-bbl oil spill would involve some employment opportunities in cleanup operations. For every mile of coastline oiled, it is estimated that approximately 100 temporary workers would be employed for a period of about two months in the cleanup operations. Employment from oil spill cleanup activities is approximately equivalent to 800 person-years of employment. But it is expected that employment would be temporary and would not involve any population increase.

(13) Impacts on Vessel Traffic

There is the potential for impacts from the assumed spill to large marine vessels and local commercial fishing vessels. Ship traffic may be rerouted around the spill for the duration of at-sea-cleanup activities (which could last from 30 to 60 days). Rerouting would be an inconvenience to shipping transiting the area, and there would be some expenses due to additional travel time, fuel, and labor costs. In addition, there would be costs related to damage to fishing and recreational boats, if oil contacts any vessels in the area and/or boats are precluded from leaving port.

(14) Impacts on Fisheries

COMMERCIAL FISHERIES: Locally, more than half of the combined landed value to ports within the Santa Barbara region is composed of sea urchin, abalone, lobster and crab harvested by fixed gear fishermen and commercial divers. If catches were reduced as a result of an oil spill of 100,000 bbl, the subregion could experience a number of impacts, including high economic losses for at least two seasons ranging from 20 to 30 percent. Unemployment of more than 10 percent among fixed-gear fishermen could eventually result.

Assuming the oil spill tainted fisheries resources or contaminated fishing gear, fishermen could be expected to sustain economic losses for about one month or as long as it takes to clean their gear. According to the scenario, the highest potential impact involving the closure of important fishing ports would not occur since the spill is not assumed to contact any important commercial fisheries associated port.

In the Santa Barbara area, the oil spill would be expected to cause high economic losses for at least two seasons ranging from 20 to 30 percent to the fixed gear fishermen and commercial divers. Unemployment of more than 10 percent among fixed-gear fishermen would eventually result. Considering the Southern California on a regional level, impacts caused by the spill would not be distinguishable from normal fluctuations.

RECREATIONAL FISHERIES: The hypothetical oil spill would preclude all sportfishing in the affected area for approximately a month when until cleanup and dispersion of oil has been accomplished. A large spill may result in the loss of fish and invertebrate resources, decreased resource accessibility, and possibly reduced desirability of fish and invertebrates through tainting. However, the mobility of the party and private vessel sportfishing fleet will facilitate avoidance of affected areas and lessen the impacts from possible reductions in available catch, possible capture of tainted fish, and contamination of gear.

Fishing and diving activities on the shores and shallow nearshore areas between Point Sal and the western Santa Barbara Channel and San Miguel Island would be halted until after cleanup operations are completed or the spill had been dispersed by wind and wave action which is assumed to be approximately 1 month.

(15) Impacts on Subsistence

Impacts from the assumed spill in rocky intertidal areas are described in section IV.H.3. An oil spill contacting these areas would cause noticeable mortalities and alteration of ecological relationships within the rocky intertidal community. Recovery could be retarded in some species for a year or longer. Therefore, a 100,000-bbl oil spill that contacts an intertidal gathering area could cause a reduction in the availability or desirability of one or more subsistence resources for up to a year.

(16) Impacts on Archaeological Resources

The archaeological resources subject to impact from a 100,000-bbl oil spill include onshore and offshore prehistoric and historic sites from approximately Pt. Sal to the western end of the Santa Barbara Channel. Offshore archaeological resources would only be affected by oil distributed in the water column which reaches the bottom and contacts those resources. In the event those offshore resources were eventually recovered, information on the age of some artifacts could be lost due to contamination by hydrocarbons.

In the event the spill did occur and contact the shoreline, a temporary degradation of the viewshed of any historic or prehistoric sites in the contact area could occur for the duration of the spill and cleanup operations. This could negatively affect the site's National Register eligibility. It is anticipated that spill cleanup operations will take approximately six weeks. Once cleanup is completed, the viewshed is expected to return to its pre-spill state.

There is a potential for onshore sites to be accidentally damaged or destroyed during spill clean up operations. The crisis atmosphere of a clean up operation will likely preclude a survey for archaeological resources in the area contacted by the spill.

(17) Impacts on Recreation and Tourism

The severity of impacts to recreational resources from a spill of 100,000 bbl or greater will vary considerably depending on many factors, including the location of the affected area, time of the year, and condition of the oil when it contacts the shoreline. Using the scenario identified for the 100,000-bbl spill in the Pacific OCS Region, oil is assumed to contact San Miguel Island, Santa Rosa Island, Pt. Sal State Beach, Ocean Beach County Park, Jalama Beach County Park, Gaviota State Park, Refugio State Beach, and El Capitan State Beach in the summer months. Oil spilled as a consequence of this hypothesized event could contact Jalama Beach County Park within 24 hours. The remaining sites listed above could be contacted over a thirty day period following a spill.

Large volumes of spilled oil would be expected to inhibit beach use, recreational boating, fishing, surfing, diving, and similar ocean-oriented recreational activities at sites affected by the spill. Further, safety concerns would likely cause the entire onshore and offshore clean up area to be closed to public use for the duration of clean up activities, estimated to last six weeks. The impact of this closure to a recreational area during peak summer season would mean a reduction in the number of users and an economic loss to merchants in nearby communities. Also, a six week closure to complete clean up activities is likely to displace recreation activities to unaffected sites, increasing crowding at those sites and affecting the quality of the recreational experience.

It is reasonable to assume that some visitors may detour to the spill site to witness clean up operations. Also, some local residents who had not planned to use the recreational resources at the affected sites may travel to the site to view the clean up process. The number of visitors whose purpose is to view the spill and its clean up are not anticipated to equal the number of more traditional recreational users, nor will their expenditures equal the economic losses expected in affected local communities.

Following completion of cleanup activities, use of recreational resources at affected areas is expected to return to normal pre-spill levels. The magnitude of the spill may extend the recovery period to more than one year due to the wariness of resource users regarding the effectiveness of clean up operations on very large spills.

Financial losses to local merchants associated with the spill and beach closure may take two or more years to recover following completion of the clean up effort. Overall, impacts to recreational resources affected by the spill are expected to result in temporary financial losses to communities that derive income from the affected resource and reduced use of resources during the spill and clean up period.

Assuming a 100,000-bbl oil spill and contact with the shoreline during the peak use period, affected recreational areas could be closed for a period of six weeks during cleanup operations. Recreation resource users will be displaced for the cleanup period and nearby communities that derive income from those users will experience an economic loss during the cleanup. Following completion of cleanup activities, use of the recreational resources in the affected area are expected to return to pre-spill levels.

4. Atlantic Region

a. Introduction

A gas well blowout is assumed to occur as a result of development drilling on a lease from a sale in the proposed program in the Atlantic Region.

Geologic information gathered to date for the Atlantic OCS indicates that the hydrocarbon bearing formations will most likely contain natural gas rather than oil. The Baltimore Canyon Trough is a major geologic feature of the mid-Atlantic. Past drilling by industry on the trough discovered large quantities of natural gas, however, only a small amount of light oil. Several scenarios of "unlikely events" were considered, but, based on the greater likelihood that production from the Atlantic OCS would be mostly natural gas, it was decided that the impacts associated with a gas blowout would be analyzed.

Gas blowouts are an uncommon result of OCS natural gas and oil production. However, the potential for a gas blowout can exists. Gas blowouts can occur during transition points in operations (such as, setting surface casing, logging procedures, and preparation for production) but they rarely result in an oil spill. Historically, most blowouts have lasted 1 day or less and have ranged from 1 minute to 218 days in duration. Over the last ten years, only about 20 percent of the blowouts have had fires associated with them.

b. Assumptions

It was assumed that during production drilling, an over pressurized shallow gas zone was encountered approximately 40 miles offshore. While cementing surface casing, loss of well control occurred and the shallow gas began to blow at the mud line. Loss of well control continued for 1 day with the gas igniting after 12 hours and burning for the last 12 hours. Minor amounts of gas condensate and hydrogen sulfide were released with the gas; no crude oil was spilled. With the gas blowing out at the mudline, ocean currents kept the boil zone downcurrent from the platform with no measurable damage occurring to the platform. Continued pumping of muds down the drill stem restored control of the well one day after the blowout began.

c. Environmental Consequences

(1) Impacts on Water Quality

A well blowout could release methane (and other low molecular weight gases such as ethane, propane, and butane, but in much smaller quantities) and hydrogen sulfide gas. The rapid dissipation of hydrocarbon gases in the water column would temporarily result in levels of methane (and much smaller amounts of ethane, propane, and butane) that are sufficiently low to preclude mortality of marine organisms, unless these organisms are confined to the actual "boil" zone for a substantial period of time. Some hydrogen sulfide gas was released into the water column, but because of its low solubility and rapid dispersion, it is unlikely that it would adversely affect water quality. Water column and atmospheric concentrations of hydrocarbons will return to background levels as soon as the gas flow is stopped. A gas well blowout below or at the mud line would cause a localized disturbance of sediments and temporarily increased turbidity. No overall lowering of water quality is expected.

The presence of condensate in natural gas released into the marine environment would adversely affect local water quality because of the presence of benzenes and naphthalenes. The persistence of these relatively toxic compounds in sea water depends on such factors as water temperature and turbulence which influence the rate at which these hydrocarbons evaporate.

(2) Impacts on Air Quality

A gas well blowout which resulted in a major discharge of gas would negatively affect air quality in the vicinity of the discharge. Resultant degradation of air quality would be temporary, because such emissions are rapidly diluted and dissipated by winds in the offshore area. The fire associated with the blowout released large quantities of combustion products. However, rapid dilution/dispersion would occur, and the expected impacts of emissions are not likely to be long-term. These events would not significantly degrade air quality, nor cause onshore air quality to exceed the NAAQS's. No onshore health hazards are anticipated.

A blowout without a fire would release natural gas and hydrogen sulfide. The potential exists for high concentrations of natural gas and hydrogen sulfide in the immediate vicinity of a blowout. However, no onshore health hazards from a potential hydrogen sulfide release are indicated because of the distance from shore.

If a gas well blowout without fire occurs and the released natural gas contains appreciable amounts of condensate, local and temporary degradation of air quality would result. However, prevailing winds on the Atlantic OCS tend to keep volatile hydrocarbons well away from land; therefore, no impacts to onshore air quality would be expected. Similarly, should a fire occur in conjunction with a gas well blowout, the products of combustion would adversely affect air quality at the site of the gas release without affecting onshore air quality because of the prevailing seaward winds on the Atlantic OCS. No long term lowering of air quality is expected to result from a gas well blowout. Onshore air quality would not be affected.

(3) Impacts on Marine Mammals

The potential impacts of either a deep water or shallow water release of natural gas would likely be restricted to the area where the gas plume rises through the water column. Because the released natural gas is not appreciably soluble in seawater it would evaporate immediately. The area affected would depend on the depth of the release and the volume of escaping gas. In shallow water, the area affected would be more localized than in deep water where the gas plume may become somewhat diffuse. However, the size of the area affected, even in the case of a wellhead release, is expected to be limited.

Since natural gas is essentially insoluble in seawater, it would rise to the surface and immediately evaporate. The rising gas would form a plume which, depending on water depth and currents, could reach the surface some distance downstream from the actual point of discharge. Therefore, the extent of the sea surface affected would depend on both the water depth, well pressure, and flow rate of escaping gas.

The potential impacts on marine mammals would depend on several factors, including the amount of gas released, the presence of condensate, and the time of year at which the gas release occurred. It would be likely that resident and transient whales would avoid the area of the plume. For those species capable of echolocation, the plume should be quite apparent. Non-echolocating marine mammals with sensitive directional hearing would probably be able to determine the location of the plume.

Were whales to surface within an area affected by a deepwater natural gas release, intoxication could result. Whales would not likely be affected by a release in shallow water. Should the gas ignite, cetaceans would certainly be expected to avoid surfacing in the affected area. Because of the insoluble nature of gas and its very rapid evaporation, no bioaccumulation in marine mammals via contamination of food resources would be expected. Marine mammals are not expected to be impacted by a gas well blowout.

(4) Impacts on Marine and Coastal Birds

Due to the very low molecular weight of natural gas, it would evaporate immediately on reaching the sea surface and be subsequently dispersed by winds to low concentrations. It is unlikely that migratory bird species, substantial numbers of which fly at altitudes of 2 to 3 km (1.25 to 1.9 mi), would experience discernible impacts from a major natural gas release. Likewise, birds feeding or resting on the surface would quickly leave the "boil zone" if gas were released underwater. These factors tend to reduce or eliminate the potential for adverse impacts on bird populations which might occur at the source of a large natural gas release.

(5) Impacts on Fish Resources and Commercial and Recreational Fisheries

A gas release, even a large one, would be unlikely to have serious impacts on fish resources. Natural gas from such a release would quickly escape into the atmosphere.

The toxicity of hydrocarbons released from a gas well blowout to the marine biota depends to a large extent on the amount of condensate released into the water column. Condensate entrained in water probably persists for a period of time which is dependent on vertical mixing, water temperature, and evaporation rates of the hydrocarbon constituents (i.e., benzenes and naphthalenes) of the particular condensate. It is probable that juvenile and adult fish are able to avoid the portion of the water column contaminated by natural gas condensate. Plankton, fish eggs, and fish larvae may locally suffer mortalities if there is prolonged contact with gas condensate fractions. No impacts on fish stocks, however, are expected to result from a gas well blowout.

An accidental release of even large amounts of natural gas with, or without, appreciable amounts of condensate is not expected to affect commercial or recreational fisheries. The area surrounding the site of a natural gas blowout will, of course, be off limits to any commercial or recreational fishing boat until the gas flow is stopped. However, this would only affect fishing endeavors on an extremely small area of the Atlantic OCS and no industry-wide impacts would be expected.

(6) Impacts on Reptiles

Since natural gas is not appreciably soluble in seawater, the majority of escaped gas will rise to the surface. Depending on the water depth and currents in the area, escaping gas could form a plume which would reach the surface at some distance downstream from a subsurface blowout site. How large a surface area would be affected by emerging gas would depend on the water depth, currents, and gas flow rate.

Impacts on endangered or threatened marine turtles would primarily involve habitat exclusion during the period of actual gas release. No bioaccumulation via contamination of food resources is considered likely. It is possible that a very limited number of individuals could be perhaps lethally intoxicated by inhaling gas vapors. No impacts are expected that would affect populations of sea turtles.

(7) Impacts on Benthos

The effects of a gas release on the benthos would be minor since the gas would quickly rise to the surface and be released to the atmosphere. Some hydrocarbon contamination to benthos associated with a gas release could occur, but would be localized and minor.

Even the presence of condensate in natural gas released at or below the mud line is not likely to cause significant contamination of benthos by hydrocarbons. No impacts on populations of benthic organisms are anticipated from a gas well blowout.

(8) Impacts on Marine Vessel Traffic

A natural gas release could cause temporary delays in vessel traffic or short term changes in vessel schedules. These disruptions in marine vessel traffic patterns could last until cleanup operations were underway and any hazardous conditions created by the gas and/or condensate release were eliminated.

V

Consultation and Coordination

V. CONSULTATION AND COORDINATION

A. Process for the Preparation of the Comprehensive Program

1. Draft Proposed Program

The process for the development of the Draft Proposed Program and associated EIS was initiated with the mailing of letters soliciting comments from the Governors of affected States and the heads of interested Federal agencies. A Notice in the *Federal Register* (54 *FR* 29833) published on July 14, 1989, requested comments from all affected parties on the development of the new program. Commenters were asked to provide information and comments relevant to determining the size, timing, and location of sales and the presale process to be considered in the Draft Proposed Program. Based on the comments and information received a Draft Proposed Program was prepared and distributed for review.

2. Proposed Program

On February 25, 1991, a Notice was published in the *Federal Register* (56 *FR* 7717) requesting comments from states, local governments, other interested individuals and groups, the oil and gas industry, and Federal agencies to provide comments on the Draft Proposed Program. Comments were solicited during a 60-day comment period ending on April 26, 1991. After consideration of the comments and a revision to the analysis in the Secretarial Issue Document, the Proposed Program was published in the *Federal Register* (56 *FR* 36834). The Proposed Program was submitted to the Congress, the Governors of the affected States, and the Attorney General. The Governors and heads of Federal Agencies received a written explanation from the Department of the Interior (USDOI) concerning the reasons for the decision.

3. Proposed Final Program

A *Federal Register* Notice published August 1, 1991, solicited comments on the Proposed Program. The 90-day comment period ended October 30, 1991. A subsequent *Federal Register* Notice (56 *FR* 65668) was published on December 17, 1991, soliciting comments on alternative options to be analyzed in the Proposed Final Program. These options included the expansion of the area under consideration for lease in the Cook Inlet Planning Area in Alaska and the option of selecting St. George Basin and Hope Basin Planning Areas as those to be considered for leasing.

Based on a consideration of these comments and an updated analysis, a Proposed Final Program will be announced. This proposal will be submitted to the President and to Congress, along with an explanation from USDOI concerning the reasons for the decision. After a 60-day waiting period, final approval can be given to the new program.

B. Process for the Preparation of the Draft Environmental Impact Statement

The comment period during the preparation of the EIS closely paralleled that of the Comprehensive Program. Comments received on the Comprehensive Program were also reviewed for consideration in the preparation of the EIS.

Consultation and coordination was conducted with Federal, state, local government agencies, environmental groups, industry, and individual citizens. Coordination was carried out pursuant to the National Environmental Policy Act regulations which require a continuous and open process for determining the range of issues to be addressed and for identifying the significant issues related to the proposed action. This process not only identifies significant issues but also narrows the focus of the EIS.

1. Notice of Intent to Prepare an Environmental Impact Statement

The Notice of Intent to prepare an EIS for the Proposed Program was published in the *Federal Register* (54 *FR* 29832) on July 14, 1989, to initiate the scoping process. Comments were solicited early in the process to identify issues and alternatives which should be evaluated in the EIS. Approximately 200 responses to the *Federal Register* Notice were received providing input on the scope of the EIS. The comments and issues received were summarized and evaluated in Section I.B.

2. Preliminary Environmental Impact Statement Data Gathering

a. Data Gathering

The collection and maintenance of a comprehensive inventory of resource data is an on-going process which encourages communication with all interested agencies and groups. It not only provides the resource data for the analysis of the EIS but also identifies significant public concerns.

Information is also gathered through MMS's Environmental Studies Program (ESP). The ESP was initiated in 1973 to support USDOI's natural gas and oil program. The objective of the ESP is to establish information needed for prediction, assessment, and management of impacts on the OCS and the nearshore areas which may be affected (43 CFR 3001.7). An overview of the ESP and a general discussion by topic of the programs objectives and study results are provided in The Offshore Environmental Studies Program (1973-1989): A summary of Minerals Management Service Research Conducted on the U.S. Outer Continental Shelf.

b. Coordination Meetings

A series of meetings were held to discuss significant issues and public concerns. On April 10, 1990, an interagency coordination meeting was held with the National Oceanic and Atmospheric Administration, the U.S. Fish and Wildlife Service, the National Park Service, and the Environmental Protection Agency to discuss their comments on the scope of the EIS. The agenda included an opportunity for these agencies to clarify the issues their agency raised during the scoping process. On April 27, 1990, a meeting was held with the National Park Service to discuss an acceptable method for examining the National Parks in the EIS.

3. Comments on the Draft Proposed Program

As part of the scoping process initiated in July 1989, comments received in response to the February 25, 1991, *Federal Register* Notice (56 *FR* 7717) from affected and interested parties on the Draft Proposed Program was considered in the preparation of the EIS. This comment period ended on April 26, 1991. Approximately 700 comments were received providing additional input on the scope of the EIS. The comments and issues received were summarized and evaluated in Section I.B. Comments received on the additional options for the Proposed Final Program contained in the second *Federal Register* Notice published on December 17, 1991 were also summarized and evaluated in Section I.B.

C. Distribution of the Draft Environmental Impact Statement

The Notice of Availability of the draft EIS was published in the *Federal Register* (56 *FR* 36843) on August 1, 1991. Over 1,200 copies were distributed to Federal, State, and local agencies, interest groups, and individuals for review. The draft EIS was also available for public inspection at the MMS offices in the Alaska, Pacific, Gulf of Mexico, and Atlantic OCS Regions. Copies of the draft EIS were also available for review in public libraries located throughout the coastal States.

1. Federal Agencies

Environmental Protection Agency, Department of Commerce, Department of Defense, Department of Energy, Department of the Interior, Department of Transportation, Department of State, Marine Mammal Commission, National Aeronautics and Space Administration, United States Coast Guard.

2. State Agencies

Copies of the Draft EIS were provided to the Governors and clearing houses of the following States:

Alabama; Alaska; California; Connecticut; Delaware; Florida; Georgia; Louisiana; Maine; Maryland; Massachusetts; Mississippi; New Hampshire; New Jersey; New York; North Carolina; Oregon; Pennsylvania; Rhode Island; South Carolina; Texas; Virginia; and Washington.

3. Coastal Libraries

Copies of the draft EIS were provided to various coastal libraries in the following States:

Alabama; Alaska; California; Connecticut; Delaware; Florida; Georgia; Louisiana; Maine; Maryland; Massachusetts; Mississippi; New Hampshire; New Jersey; New York; North Carolina; Oregon; Pennsylvania; Rhode Island; South Carolina; Texas; Virginia; and Washington.

The final EIS will be available for inspection at the same locations noted above. The final EIS will be distributed to Federal, State, and local agencies, interest groups, and individuals, as well as those organizations and individuals that commented on the adequacy of the draft EIS and those who requested the final EIS.

D. Comments Received on the Draft Environmental Impact Statement

The 90-day comment period on the draft EIS closed on October 29, 1991. During this review period, written and oral comments were solicited on the adequacy of the draft EIS and to provide the Secretary of the Interior with additional information to help evaluate fully the potential environmental effects of the Proposed Comprehensive Program.

1. Public Hearings for the Draft Environmental Impact Statement

Eight public hearings were held from September 10 to September 19, 1991, at the following locations: Anchorage, Alaska; Santa Maria, California; Houston, Texas; New Orleans, Louisiana; Ocean Springs, Mississippi; Mobile, Alabama; Gulf Breeze, Florida; and Wilmington, North Carolina. A total of 262 people presented verbal comments at the hearings. In addition, 122 people presented written comments at the hearings, but did not testify. A listing of those who presented verbal and written comments at the public hearings begins on the following page.

Comments were also received on the draft EIS during a public information meeting held on October 8, 1991, by Congressman Frank Pallone in Long Branch, New Jersey. Additionally, meetings of a "dialogue"/informational character were held with local government representatives and public/private interests in California and Alaska during 1991.

Anchorage Public Hearing, September 10, 1991

Individual	Organization
Joe Jones	Alaska Legal Services
Harold Heinze	Alaska Department of Natural Resources
Bob Day	
Bert Griest	North Arctic Borough
Joan Velikanje	
Ted Raynor	
Kathryn MacMillian	
Brendon Mahaffie	
Joe Cincotta	Shell Western Exploration & Production
Linda Freed	Kodiak Island Borough
Kristen Stahl-Johnson	
Marianne Hickey	
Trisha Gartland	
Tracey Acres	
Lacey Burns	
Lynn Walton	
Kathryn Kanear	
Robert Stewart	National Ocean Industries Assocation
Paul Kelley	Rowan Companies
Steve Maxwell	
Eric Carpenter by Pam Miller	
Vonda Nixon by Pam Miller	
Carol Jensen by Pam Miller	
Joy Post by Pam Miller	
Mike O'Meara	
John Swinnerton	
Linda Feiler	
Jim David	
Barbara Winkley	
Ninilchik Traditional Council by Pam Miller	Ninilchik Traditional Council
Pam Miller	Greenpeace, U.S.A., Alaska Office
Larry Landry	
Martha Aarons	Unalakleet Native Corporation
Christopher Toal	
John Lyle	
Susan Stolz	
Suzanne Winder	
Jerry Bruckman	
Ester Lee by Pat Garube	
Pat Garube	Public Awareness Committee-Env.
Joseph Ridder	
Lynn Mickleson	
Kelly Quirke	Northern California OCS Coalition
Dorothy Smith	National OCS Coalition
Patti Pearson	
Bumppo Bremicher	
Rose Specht	
Dennis Specht	
Riki Ott	
Brian Walsh	
Cynthia Rust	
Elizabeth Balkus	
Anna Phillips	Alaska Indigenous Council-Env.
Walter Hebb	
Moses Tulem	
Nancy Hillstrand	
James Roderick	
Sallie Dodd-Butters	
Patricia Licat	
Teresa Peters	
Gail Parsons	
Fred Fellelman	
Stuart Pechek	
Marvis Mueller	
James Charlie	
Toni Armstrong	
Sonya Tobias	
Winslow Hoffman	
Linda Redmond	
Linda Smoger	
Kevin Bell	
Max Mitchell	
David Anderson	
Fred Fredroth	
Sharon Sturges	Trustees for Alaska

Wilmington Public Hearing, September 10, 1991

Individual	Organization
Gary Coye	
Donna Moffitt	North Carolina
Clark Wright	North Carolina Attorney General
David Weaver	Sonat Offshore Drilling Company and National Ocean Industries Assoc.
Micki Baker	
Derb Carter, Jr.	Southern Environmental Law Center
Ann Ehringhaus	
Tom Perlic	Clean Water Action
Brant Wise	Outer Banks Surfrider Foundation
Howard Stern	Pender Watch and Conservancy
Michael Egan	LegaSea
Cynthia Mitchell	
Ray Lee	Sierra Club, North Carolina Chapter
Steven Kretzman	Greenpeace
Elizabeth Kays	
Mary Noland	
Dorothy Bridger	

Individual	Organization
Margaret Marsh	
Michael Egan	
Ed Pickett	
Mark Thrift	
Bob Slaughter	
Josette Watts	
Georgia Smallman	
Jane Baldridge	
Robert Cutting	
Nancy Wright	
Joseph Ruse	
Bill Mansfield	
Andrew Fisher	
Kay Joyner	
Beejay Grov	
Kathy Markalina	
John Watkins	
Charles Laughon	
Martha Kane	
Marjorie Qlesue	
Charlie Rose	Congressman, North Carolina

New Orleans Public Hearing, September 11, 1991

Individual	Organization
John Kennedy	Governor, Louisiana
Terry Howey	Louisiana Dept of Natural Resources
Tim Herbert	Louisiana Dept of Natural Resources
Robert Wiygul	Sierra Club Legal Defense Fund
Steve Sinclair	Oryx Energy Company
Paul Kemp	Coalition to Restore Coastal Louisiana
Nell Carmichael	Sierra Club, Delta Chapter

Houston Public Hearing, September 12, 1991

Individual	Organization
Doug Noah	Oryx Energy Company
Martin Kopacz	Shell Oil Company
Brandt Mannchen	Sierra Club, Lone Star Chapter and Houston Group
Bob Sleet	Global Marine, Inc. and National Ocean Industries Assoc.
Reed Bitter	Marathon Oil Company

Ocean Springs Public Hearing, September 17, 1991

Individual	Organization
Dwight Johnson	Texaco Exploration & Producing, Inc

Mobile Public Hearings, September 18, 1991

Individual	Organization
Dan Greathouse	Unocal Exploration Corporation
Harold Cargol	Texaco Exploration & Producing, Inc
David Weaver	Sonat, Inc. and Sonat Offshore Drilling

Gulf Breeze Public Hearing, September 19, 1991

Individual	Organization
Debbie Tucker	Governor, Florida
Steve Kritzmire	Greenpeace
Ann Whitfield	Florida Public Interest Research Group
Donna Deblin	Center for Marine Conservation
Term Smith	National Ocean Industries Association
Bill Suarez	Florida Audubon Society
Nathan Manwell	Florida PERG
Willie Junior	Escambia County Board of County Commissioners
Frank Bozeman	Representative Scott Clemens
Bob Condon	Senator Connie Mack
Jennifer Brownley	UWF Greens
Rita Manley	
Patty Weatherford	
Allen Gonia	Mother Earth
Amy Fernans	
Tom Banjanin	Florida State Representative
Cherie Himes	
Jason Harvey	Citizens In Action
Robert Turpin	
Josephine Billups	Save America's Valuable Environment
Grover Davis	
R. W. Wagner	
Corbin McMullen	
Angela Bowen	Florida Public Interest Research Group and UWF Pensacola Greens
Wesley Poole	
Lisa Rutledge	
Lisa Wexler	

Individual	Organization
Karen Russell	Florida Sand Lease
Paul Goudy	
Rip Hanks	Safari Club
Jeffrey Shawn Boyington	
J. J. Waters	
Steven Kurtz	Environmental and Beach Aesthetics Committee for Pensacola Beach
Thomas McAlpin	
Bill Young	
Perin Pennyman	
Linda Young	
John Finora	
Steve Eyman	
Eric Fitch	
Cathy Pascoe	
Dan Nelson	
Lisa Morrison	
Yvonne Smith	
Terry Kitchell	
Deana Douglas	
Kimberly Catsburger	
Joe Trappin	
Francis Denham	
Krista Young	
Bill Young	
Douglas Gary	
Phil Benton	
Brickard Lane	
Sammie Mattix	
Maria Elana Yo	
Amanda Campbell	
Caryn Russell	Florida Families (petition)

Santa Maria Public Hearing, September 18, 1991

Individual	Organization
Kristie Dalidio	Congressman Panetta
Peggy Good Cordero	Senator Hart
Diane Owens	Santa Barbara County Board of Supervisors
David Blakely	San Luis Obispo Board of Supervisors
Evelyn Delany	San Luis Obispo County
Kurt Kupper	Environmental Center
Pilulaw Khus	Northern Chumash People
Sheila Lodge	City of Santa Barbara
Norman deVall	Mendocino County Board of Supervisors
Carla Frisk	Assemblyman Jack O'Connell
Stephanie Harlan	City of Capitola
James Merkel	
Chuck Comstock	Grover City
Britt Phillips	Port of San Luis Harbor Commission
Marc Chytilo	Environmental Defense Center
Alex Hinds	San Luis Obispo County Planning and Building
John Euphrat	San Luis Obispo County Planning and Building
Harry Farmer	
Ben Luna	City of Morro Bay
Avis Austin	League of Women Voters of San Luis Obispo
Ruth Saadi	League of Women Voters of Santa Barbara
Bennett Johnson	
Terry Covington	California Coastal Operators Group
Rod Holmgren	Sierra Club, National OCS Committee, Vantana Chapter, & State of Washington
Edwin Montgomery	
Herod Lowery	
Bill Harvey	
Nell Langford	Hands Across Our Beaches
Susan Mullen	Morro Bay City Council
Rich Hansen	Shell Oil Company
Edith Schrader	
Raymond MacKenzie	Peace and Freedom Party
Henry Feniger	Get Oil Out
William Hewston	California Energy Service & Supply Association
Donna Nowland	California Chamber of Commerce
Jim Diani	Santa Maria Valley Economic Dev. Association
Bob Engel	Santa Maria Valley Chamber of Commerce
Kelly Quirke	Greenpeace
Laurie Zaun	Sea Link Ocean Storage Ships
Frank Morin	

Individual	Organization
Richard Krantz	Ocean Sanctuary Coalition of San Luis Obispo County
Karl Kempton	
Jennifer Sampson	
Steve Soza	
Shawn Durkin	Oceaneering International and California Operators Association Group
Freddy Daniel	
Nancy Culver	San Luis Obispo Mothers for Peace
Jane Yokoyama	City of Santa Cruz
Pat Kingston	
Richie Ray Walker	
Keith Denny	
Claude Kiesel	
Randy Ruff	
Evan Dill	
William Ralph	
Adrian Combs	
David Putney	
Brian Turner	
Randy Davis	
Trish Yngelmo	
Phil Evans	
Gary Kirkland	
John Monty, Jr.	
Travis Evans	
Margaret Lightfoot	
Carl Samuelson	
Melissa Rissman	
Bernadette Delmore	Pismo Beach Chamber of Commerce
Justin McKenzie	
Richard Robinson	
Dave Parley	
Maria Brousse	
Robert Mebane	Ocean Sanctuary Coalition of San Luis Obispo
John Flagg	
Tina Metzger	
Richard Shafer	
Ron Rayburn	
Peter Sterios	
Judy Kessler	
Dorene Garvin	
Nick Homick	
Michael Wollman	
Linda Seeley	
Marcy Isreal	
Leon Panetta	Congressman Panetta
Gary Hart	State Senator, 18th District
Zella Rushing	California Chamber of Commerce
Nancy Williams	Ventura County Econ. Development Assoc.
Joseph Boud	
Dean Davis	
Lorraine Munguia	

Santa Maria Public Hearing, September 18, 1991 (con't)

Individual	Organization
John Van Wey	
Steven Scheye	
Petition	Save the Coast
Victoria Mixon	
Maya Andlies	
George Luna	
Robert Sollen	Sierra Club, Los Padres Chapter
Michele Conroy	
Kathi Niffenegger	
Cheryl Larson	
Kelly Rae Larson	
Ray MacKenzie	
Edith Schrader	
Petition	Physical Therapy, Inc
Alice Alldredge	University of California, Santa Barbara
Barbara Schaeffer	
Kathie Franklin	
Dr. Clmiloboze	
Susan Moore	
Britt Phillips	Port San Luis Harbor District Commission
William Meyer	
Kimberly Kellner	
Thomas Goeries	
Luke Teyssier	
Bill Denneen	Friends of Point Sal
Bud Strauss	
Marlyn Armstrong	
Steven	
Mo Hainer	
Mary Lou Latzer	
Carol Rowland	
Mary Lou, Robert, & Zackery Ervin	
Cheryl Lynn Emrick	
Maureen Lance	Santa Barbara Wildlife Care Network
Jeanine West	
M. Wheeler	
Rev. Stevens	
Charles	
Marsha Thistle	
Hans Hansson	
Roger Zimmerman	Sierra Club, Arguello Group
Eunice Ella, Jack, & Eunice Loretta Pierce	
John Kelleher	
Peg Kelleher	
Marcelle Bakula	
Allen Settle	
Allan Naydol	
Kerrie Palermo	
Tara Wiskowski	
Rosemary Donnell	
James Perry	
Olga Howard	
Mary Alice Orcutt Henderson	California Energy Service & Supply Association

Individual	Organization
Muriel Boerboom	
Michael Mara	
Pete Wilson	Governor, State of California
Michael McGee	
Barry Putman	
Ronald Decarli	San Luis Obispo Area Coordinating Council
Norman De Vall	Mendocino County Board of Supervisors
Henry Wessels	
Jack O'Connell	Assemblyman, 35th District
Patricia Beltranena	
Bill Hewston	Measurement and Control Engineering and National Ocean Industries Assoc.
Russ Smith	Ventura Visitors & Convention Bureau
Paul Owen	Greater Ventura Chamber of Commerce
Jan Bradford	
Dorene Garvin	
Posters from:	
Chris Hertler	
Jermy Griffin & Jason Grubbs	
Audrey Halsell	
Indra Foryney & Natasha Kaigel	
Katie Herman	
Ramona, Kristina, & Jennifer Nellis	
Earlene Cuelho	
Brian Buchanan	
Kevin Baugh	
Dave Husk	
Douglas Livesay	
Velma Violich	
Christina Green	
Franklin Frank	
Brian Stansbury, Crystal McMeean,& Gina Thompson	
Jennifer Church	
Tatiana Marcucci & Brenda Kane	
Petition	Bike Riders
Thomas Workman	
Thais Thompson	
David Parro	
Michael Reid Kitachen	
Mike Barth	
Kenneth Havard	
Linda Owen	
Jeff Chambaers	
Lori Redhair	
Brian David Cully	
Video Tape	

2. Written Comments

The following is a list of approximately 450 organizations and individuals who submitted written comments. This total number of organizations/individuals does not account for the multiple signatories received, as e.g., in a petition, however, such multiple signatories are noted in the listing itself.

In addition, approximately 140 organizations and private citizens provided comments on the Proposed OCS Comprehensive Program or the draft EIS directly to the State of California. A listing of these commenters and copies of the comment letters/testimony are included in the October 29, 1991, written response by Pete Wilson, Governor of California, to the Proposed OCS Comprehensive Program and the draft EIS.

Much of the written material received by MMS that pertains to the EIS is reproduced in Appendix G. The comments included in Appendix G are representative of all the substantive issues and concerns that were raised during public review of the draft document.

FEDERAL GOVERNMENT

AGENCY	NAME
U.S. Department of Transportation	
Coast Guard	
Environmental Protection Division	L.J. Beach
U.S. Department of Health and Human Services	
Public Health Service	Kenneth W. Holt
U.S. Department of Commerce	
National Oceanic and Atmospheric Administration	David Cottingham
U.S. Department of the Air Force	
Eglin Air Force Base	Robert J. Arnold
Vandenberg Air force Base	Stephen C. Sherwood
U.S. Environmental Protection Agency	Richard E. Sanderson
U.S. Department of the Interior	
Fish and Wildlife Service	Richard M. Smith
Atlanta, Georgia Office	James Williams
National Park Service	Denis Galvin
U.S. Congress	Alan Cranston & 26 signatories

STATE GOVERNMENT

AGENCY	NAME
Texas	
Texas Historical Commission	James E. Bruseth
Oregon	
Oregon Intergovernmental Project Review	Bob Prinslow
Connecticut	
Department of Environmental Protection	Arthur J. Roque, Jr.
Washington	
Office of the Governor	Booth Gardner

STATE GOVERNMENT (con't)

AGENCY	NAME
Florida	
Office of the Governor	Lawton Chiles
Department of Environmental Regulation	Mark Latch
Department of Commerce	Wynelle Wilson
South Carolina	
Governors Office - Intergovernmental Review	Christopher Neeley
Water Resources Commission	Earle Powell
Coastal Council	Stephen Snyder
Governors' Division of Energy, Agriculture and Natural Resources	Carlisle Roberts, Jr.
Human Affairs Commission	Earle Brown, Jr.
Governors Office - Energy, Agriculture and Natural Resources	Carlisle Roberts, Jr.
Marine Resources Research Institute	Victor Burrell, Jr.
Environmental Evaluations	Jane D. Settle
Alabama	
Geological Survey of Alabama	Ernest A. Mancini
Alabama Department of Economic and Community Affairs - Alabama State Clearinghouse	Moncell Thornell
Alabama Historical Commission	F. Lawrence Oaks
Louisiana	
Department of Natural Resources	Martha A. Swann
Coastal Management Division	T. Hebert
Coastal Management Division	Terry Howey
Louisiana Geological Survey	Charles G. Groat
Department of Natural Resources	unsigned
Department of Wildlife and Fisheries	A. Kell McInnis, III
Department of Transportation and Development	Neil L. Wagoner
Department of Culture, Recreation and Tourism	Henry A. Truxillo
Department of Environmental Quality	Paul H. Templet
California	
Office of the Governor	Pete Wilson
State Water Resources Control Board	W. Don Maughan
Department of Transportation	Robert Joseph
Department of Fish and Game	Pete Bontadelli
Air Resources Board	Jananne Sharpless
State Lands Commission	Dwight Sanders
Assemblyman, California Legislature	Jack O'Connell
Port San Luis Harbor District, Board of Commissioners	Carolyn Moffatt
California Coastal Commission	Susan Hansch
Controller of the State of California	Gray Davis
California Legislative Assembly	K. Jacqueline Speier
Virginia	
Council on the Environment	Keith J. Buttleman
Department of Conservation and Recreation	John Davy, Jr.
Department of Mines, Minerals and Energy	Robert Milici
Marine Resources Commission	Erik Barth
State Water Control Board	Rick Weeks
Virginia Institute of Marine Science	Robert Byrne
Virginia Port Authority	R. Todd Coyle

STATE GOVERNMENT (con't)

AGENCY	NAME
North Carolina	
Office of the Governor	James G. Martin
Department of Administration	Donna D. Moffitt
Department of Environment, Health, and Natural Resources	
Project Review Coordinator	Melba McGee
Planning and Assessment	Douglas Lewis
Planning and Assessment	Bill Flournoy
Marine Fisheries	William T. Hogarth
Environmental Management	Alan Clark
Environmental Management	Sammy Emerson
Environmental Management	Larry Ausley
Planning and Assessment	Greg Pittman
North Carolina State University	
Department of Economics	Kerry Smith
Agricultural Extension Service	J.E. Easley, Jr.
New York	
Department of Environmental Conservation	Gregory H. Sovas
Alaska	
Office of the Governor	
Division of Governmental Coordination	Paul Rusanowski
Maryland	
State Clearinghouse	Mary J. Abrams
Department of the Environment	Susan Scotto
Department of Natural Resources	Ray C. Dintaman
Massachusetts	
Executive Office of Environmental Affairs	Susan F. Tierney

LOCAL GOVERNMENT

AGENCY	NAME
Maryland	
Town of Ocean City	Jesse C. Houston
Town of Ocean City	Roland E. Powell
Worcester County Commissioners	Reginald Hancock
Florida	
City of Destin	James W. Vaughn
Broward County	
Office of Planning	Donald Burgess
Brevard County	
Board of Commissioners	Sue Schmitt
Apalachee Regional Planning Council	Charles D. Blume
North Central Florida Regional Planning Council	Charles L. Kiester

LOCAL GOVERNMENT (con't)

AGENCY	NAME
California	
County of Santa Cruz	Fred Kelley
Port San Luis Harbor District	
Board of Commissioners	Stephen P. Leane
City of Laguna Beach	Neil Fitzpatrick
Monterey County	
Planning & Bldg. Inspection Dept.	Steven Maki
Board of Supervisors	Sam Karas
Board of Supervisors	Karen Strasser Kauffman
Mendocino County	Norman L. DeVall
County of Santa Barbara	
Board of Supervisors	E. Dianne Owens
Resource Management Department	John Zorovich
City of Morro Bay	Rose Marie Sheetz
County of San Luis Obispo	
Board of Supervisors	David Blakely
Air Pollution Control District	Robert Carr
Board of Supervisors - District Two	Lawrence L. Laurent
San Luis Obispo County Planning Department	John Euphrat
San Luis Obispo Area Coordinating Council	Penny Rappa
Southern California Association of Governments	John Flynn
City of San Buenaventura	
Environmental Impact Report Committee	Steve Chase
Association of Monterey Bay Governments	Robert Nunn
City of Santa Cruz	Jane Yokoyama
City of Santa Barbara	Dale T. Brown
City of Pacific Grove	Florence B. Schaeffer
City of El Segundo	Kendra Morries
County of Ventura	
Resource Management Agency	Thomas Berg
City of Monterey	Bill Wojtkowski
South Coast Air Quality Management District	Cindy S. Greenwald
Virginia	
Hampton Roads Planning District Commission	Arthur Collins
Alaska	
City of Nome	John K. Handeland
City of Homer	Harry E. Gregoire
Northwest Arctic Borough	Chuck Greene
North Slope Borough	Jeslie Kaleak
North & Northwest Mayor's Conference	Robert Foote
North Carolina	
Town of Manteo	
Alabama	
South Alabama Regional Planning Commission	Don W. Brady

PUBLIC INTEREST GROUPS AND INDUSTRY

ORGANIZATION	NAME
San Luis Obispo Chamber of Commerce	Dennis D. Law
Friends of Point Sal	
H&H oil Tool Company, Inc.	Robert Hasselbrock
Alaska Legal Services Corporation and Native American Rights Fund	Joseph D. Johnson & Lawrence D. Aschenbrenner
Bering Straits Native Corporation	Guy Martin
Santa Maria Valley Economic Development Association	Roger D. Bunch
Taxpayer Association Santa Barbara County	Ralph McNall
Sanibel-Captiva Audubon Society	Robert E. Slayton
CAN Citizens' Action Network	Patricia Kearney & Lola Sorensen
Oasis Biocompatible Products	A. Ludwig, E. Halepatz & two signatories
People for a Nipomo Dunes National Seashore	Jack Beigle
Kawarek, Inc.	Loretta Bullard
NANA Regional Corporation, Inc.	Pete Schaeffer
Compuserve Information Systems Scuba Forum	F. Howard
League of Women Voters	Connie Hannah
San Luis Obispo League of Women Voters	Beverly Hund
League of Women Voters of Dare County, North Carolina	Jeanne Reporter
Santa Ynez Planning	Patricia Beltranena
New England Aquarium Dive Club	Jean Stefanik
Divers Environmental Survey	John Hicks-Courant
Aquatic Explorers Scuba Divers Club	Thomas Cook
Mobile Bay Audubon Society	Myrt Jones
Mudhole Divers	Mary Bowles
Alaska Oil and Gas Association	William Hopkins
Citizens for Adequate Energy	Walter Schroeder
Grandview Mesa Homeowner's Association	Jerry Hill
Friends of the Sea Otter	Susan Schiavone
Sierra Club, Loma Prieta Chapter	Jeans & Bill Morris
Friends of Hatteras Island	Carol Anderson
Citizens Association of Bonita Beach	Marjorie F. Ward
League of Women Voters of California	Alison Fuller
American Lung Asoociation of Monterey, Santa Cruz and San Luis Obispo	Janet E. Stecher
Sierra Club, Northwest Florida Group	Richard D. Radford
League of Women Voters of Oregon	Kappy Eaton & Phyllis Cottingham
Sierra Club, Lone Star Chapter - Coastal Committee	F. Herman Rudenberg
Texaco	D.C. Hartman
Carribean Conservation Corporation	Susan Marynowski
Project Reefkeeper	Robin Lamberta & Alexander Stone
Sierra Club, Natl. OCS Subcommittee	Shirley Taylor
Addenda	Brandt Mannchen
League of Women Voters of Ventura County	Katie Fellows
Eco Slo	Kurt Kupper
Public Awareness Committee for the Environment	Patricia Garoutte & Susan Winder
Exxon Company	Omer R. Humble
Greenpeace	Carol Alexander
Kotzebue Elders Council	Rachel Craig
American Petroleum Council	S.P. Chamberlain
Coalition to Restore Coastal Louisiana	Paul Kemp
Sierra Club, Lone Star Chapter	Brandt Mannchen
Cook Inlet Seiners Association	Angela Wickham
Sitnasuak Native Corporation	Robert Fagerstrom
Shell Oil Company	Douglas Beckman
Friends of the Earth	Diana Nelson
Alaska Eskimo Whaling Commission	Burton Rexford
Ocean Sanctuary Coalition of San Luis Obispo	Richard Kranzdorf
Central California Council of Diving Clubs, Inc.	Clay Phipps

PUBLIC INTEREST GROUPS AND INDUSTRY (con't)

ORGANIZATION	NAME
Talkeetna Environmental Center	Becky Long
Unocal	J.S. Attebery
Bristol Bay Coastal Resources Area	Susan Flensburg
North Carolina Beach Buggy Assoc, Inc.	George Deems
Sierra Club-Delta Chapter, Legal Defense Fund, Inc	Robert Wiygul
Sierra Club (for National Parks and Conservation Association, and Greenpeace USA)	Robert Briggs
Natural Resources Defense Fund (for OCS Regional Studies Program, Natural Resources Defense Fund, Greenpeace USA, Center for Marine Conservation, American Oceans Campaign, Trustees for Alaska, National Wildlife Federation, Southern Environmental Law Center, LegaSea, Clean Ocean Action, and South Carolina Coastal Conservation League)	Johanna H. Wald & Ann Notthoff
Environmental Defense Center	Marc Chytilo
Oil Reform Alliance	Riki Ott
Kodiak Environmental Network	Kristin Stahl-Johnson
Surfari Club	Lance Little & 323 signatories
Marathon Oil Company	H.J. Koenig
Exxon Company	Thomas Tibbitts
Coastal Resource Center	Eugenia Laychak
North Carolina State University	
Department of Economics	Kerry Smith
Agricultural Extension Service	J.E.Easley, Jr.
Virginia Institute of Marine Science	Robert Byrne
Cook Inlet Vigil	Elizabeth Balkus & James Roderick (and petition)

PRIVATE CITIZENS

Individual	State
Adams, Francis	Alaska
Allen, Paul	Pennsylvania
Allen, Paul	California
Anderson, Adele	California
Anderson, Rodger	California
Anderson, Maas	California
Anderson, Shar	California
Andrews, Michael	California
Arozene, Donna	California
Avera, Lane	California
Avina, Donna	California
Baer, Franklin and Alma	California
Bailey, Donald	California
Baldridge, Jane	North Carolina
Baldwin, Anne	California
Bales, John	California
Banks, Emily	California
Bash, Debi and Jimmy	California
Bashaw, Rebecca	California
Bastiani, Mr. and Mrs. Wesley	California
Beers, John	California
Bjorklund, Anne	Califonria
Bendix, Jane	California
Bengford, Bob	California
Bishop, Eric	California
Blank, William	Florida
Blake, Robin	California
Bollinger, Phillip	California
Bondy, Coleen	California
Bondy, Dirk	California
Booth, Kathryn	California
Boyle, Steve	California
Brancart, Victor	California
Brand, Loman and Betty	Nebraska
Bromley, Jason	California
Bronsse, Maria	California
Brooks, Paul & 3 signatories	Florida
Brown, Molly	California
Bryant, Mary	California
Buckmaster, Wilson & Lee Ellen	California
Buffi, Laura	California
Calcaterra, Janet	California
Case, Gloria	Florida
Cassidy, Melvin & Ofelia Garcia	California
Cassidy, Paul & Cathryn	California
Cassidy, James	California
Caudill, Janelle	Colorado
Chandler, Arlene	California

PRIVATE CITIZENS (con't)

Individual	State
Chandler, Everett	California
Chaplick, John	Massachusetts
Christensen, John	North Carolina
Christine Dodson	California
Cicero, Vincent	California
Coe, Dana	California
Cogswell family	California
Cohn-Burke, Nancy	California
Cole, Andrew	Colorado
Confer, Stephen & Kathleen	Oregon
Cook, David	California
Corkins, Kim	Florida
Crane, Franklin	California
Crossler, Mark	Oregon
Crotzer, Shoosh	California
Danielsen, Karen	California
Davis, Dean	California
Dawson, Katie	Alaska
Day, Robert	Alaska
DeGhionno, Mr. & Mrs. Thomas	California
Dennen, Stephen	California
Dennen, William	California
Dent, Lisa	Pennsylvania
Duncan, Kathy	California
Dunivant, Terri	California
Earley, James	California
Eaton, R.	California
Eddy, Ernest & Barbara	California
Eide, Patricia	California
Ellard, John	California
Ensworth, James	California
Ervan, Henry and Imogene	California
Erwing, Roger	California
Evans, Travis & Katherine	California
Evans, William	California
Fairs, Gessep	North Carolina
Faulstich, Nancy & Harry	California
Feiler, Linda	Alaska
Fels, Peter	California
Firestone, Shirley & 3 signatories	California
Ford-Maloney, Ken & Julie	California
Foster, James	California
Fullerton, Robert	Missouri
Gabriel, Timothy	California
Garbow, Pat	California
Gates, Dorothy	California
Gaugh, Doris	California
Germain, Barbara	California
Gingrich, Nancy	California
Gratch, Jonathan	Illinois
Groves, Julie	California
Hadjiane, Thomas and Meredith Porter	California
Haggblom, Lisa	Alaska
Hambleton, Elizabeth	Florida
Hanauer, Donald	California
Hardin, Kristi	California
Harte, Mary Ellen	California
Henry, William & Susan	California
Herrera, Gabriel	California
Hess, Ruth	Florida
Heuer, Kristi & Sandy Scherer	California
Highfill, Debbie	California
Holt, Ron	California
Holt, Tandra	California
Hughes, Amy	California
Hurry, David	West Virginia
Hurst, William	California
Hyer, Edgar	California
Jacobsen, Lynn	California
Jarrell, Catherine	California
Jarrell, C.	North Carolina
Jeffries, Keith	California
Jenkins, Thomas	Florida
Johnson, Madeleine	California
Johnson, Otis Jr.	North Carolina
Judd, Robert	California
Kamoda, Dawn	California
Kawa, Staci	California
Kelleher, Erin	California
Kelly, Dean	Washington
Kennmer, Jody & 16 signatories	California
Kerr, Pat	California
Kingston, Pat	California
Kirby, Patricia, Louis &Joseph	California
Kirkman, Arden	North Carolina
Kitts, Norma	California
Kjeldergaard, Kerri	California
Knight, Virginia	Florida
Knox, Craig & Patricia	California
Kork, Arthur	California
Krupp, Catharine & 15 signatories	California
Kummerow, Barbara	California
Lain, Martha	North Carolina
Laing, Josephine	California
Lanier, Elizabeth	California
Lapp, Ruth	California
Lewis, Marc	California
Loomis, R.C.	California
Loomis, Richard	California
Lovejoy, Elisah	Califronia
Lupfer, Virginia	California
Machen, Patricia	California
Madison, Evelyn	California
Mansbridge, Edith	California
Mansperger, Barbara	Florida
Marcucci, Tatiana	California
Marcus, Jackie	California
Marketello, Jane	California
Marshall, Sally	California
Martin, Melvin	California
Matteson, Thor	California
Matteson, Teri	California
Matthews, David	Arizona
Maxwell, Stephen	Alaska
McGee, Michael	California
McGrath, Dee & Jim	California
McIntyre, Leslie	North Carolina
McMahon, Jeff	California
Meier, Alan	Illinois
Melton, Iris	Florida
Metteauer, Don	California
Meyer, Peter	North Carolina

PRIVATE CITIZENS (con't)

Individual	State
Miller, Michael	California
Moffet, Phillip	California
Monteverde, Lisa & Chris Martin	California
Moon, Dale	California
Muir, John	California
Mulder, Gloria	California
Mullen, Jerald	California
Murray, Jane	California
Naftel, Jim & Rebecca	California
Nagao, Julie	California
Nagy, Wanda	North Carolina
Nash, Theresa	California
Nelson, Ida	California
Nelson, Kelly	California
Nelson, Jodie Robb	California
Nelson, Mark	California
Nelson, Eric	California
Norwood, Nancy	California
O'Connor, Susan	California
Odom, Lei Lynn	California
Olejczak, Joshua J. Mrs.	California
Owen, Karen	Florida
Owens, Celine	California
Panetta, Kim Hurd & Daniel Lee Panetta	California
Pearson, Patrici	Alaska
Peck, John	Wisconsin
Pedrick, Edward	California
Perez, Jan	California
Perrin, Robin	California
Perry, Dawn	California
Peters, Allan & Jeanne	California
Peterson, William	Minnesota
Poirot, Steve	Alaska
Porter, C.J. & 5 signatories	California
Potter, Scott	California
Power, Will & Debbie	California
Power, Jennifer	California
Powers, Aquinas	California
Printup, Deb	North Carolina
Quinn, Thomas	Colorado
Rathmell, George	California
Redish, A. David	Pennsylvania
Reilsperger, Deanna	California
Reimer, Kim	California
Reisenowitz, Michael	California
Reno, Jean	California
Richards, Elaine	California
Richardson, Jonas	California
Ricj, Pamela	Florida
Ridge, Frank	California
Riggins, Richard, Cecelia & Skyla	California
Risley, Kay & Bruce	California
Rogers, Kenneth	North Carolina
Ron, Nancy	California
Ross, Nancy	California
Rowe, Jeffrey	North Carolina
Rusnak, Mary Ann	California
Rust, Cynthia	Washington
Samuelson, Karen Lee	California
Samz, Charles	Georgia
Santacquas, Joseph & James & family	California
Schaeffer, Barbara	California
Schibig, Julie	California
Schiller, Allen	California
Seleznow, Jane	California
Shepherd, Sharon	California
Sheppard, Mary	Florida
Sistek, Neal	California
Sletteland, Holly	California
Smethers, Kristin	California
Smith, Christine	Californi
Smith, Marie &Jim	California
Smith, A.C.	California
Smith, Eugene	Alaska
Smith, Yvonne	Florida
Smith, Julie and Irvin	California
Stamp, James	North Carolina
Stark, Cynthia	California
Stephens, Chris	Pennsylvania
Sterios, Peter	California
Stevens, Robert & 48 signatories	California
Stilwell, Barbara	California
Stone, Jim	California
Strauss, Bud	California
Teichert, Ramona & 3 signatories	California
Thibault, Ron	California
Tilghen, Merrill	California
Tognazzini, Wilmar	California
Vickers, Diane & 5 signatories	California
Vigil, Eva	California
Vink, Cornelius	California
Walsh, Paul	California
Watts, Josetta	North Carolina
Weiss, Frederick	California
Wells, Debbie	North Carolina
Westby, Priscilla	California
Whitworth, Patrick	South Carolina
Wikholin, Ron	California
Wilmoth, Deborah	Florida
Wolf, Kenneth	California
Wolf, Kenneth	California
Woo, Amanda, Angelina, Li & Mini	Virginia
Wood, Lea	Califronia
Wright, Joi Henderson	California
Wright, Thomas	California
Wright, Nancy	North Carolina
Wright, Naoma, Kenneth & Bruce	California
Zahn, Raymond	California
Zahn, Lori	California
Zima, Paula	California

3. Responses to Comments

A total of approximately 800 organizations and private citizens commented on the draft EIS. All comments received were reviewed and pertinent comments dealing with the analysis in the EIS were analyzed to determine whether changes were necessary in the EIS. Where minor, generally technical changes were required, they were made in the text without acknowledgement. The following is a summary of the major issues raised by the commenters and the responses to these issues including, where appropriate, an indication of resulting changes made in the final EIS.

ISSUE 1. The EIS Preparation and Review Process Were Faulty.

a. Definition of Issue

Several commenters stated that the public hearing process for the draft EIS was inadequate. Commenters criticized MMS for the limited number of public hearings, the dates, times, size, and the locations where the hearings were held, and the lack of notification. Several commenters stated that the public hearing in Santa Maria was poorly planned and, therefore, did not provide an adequate opportunity for the public to provide testimony. Several commenters from Alaska were concerned that the dialogue meetings which were held would not become part of the official congressional record.

Commenters stated that the format and size of the EIS prevents the general public from reviewing the document and providing comments. A few commenters recommended that the document be reorganized by region and if not, regional booklets be prepared. Others recommended that the Table of Contents and the Index be revised to assist the reader in locating specific information or a particular environmental resource.

Commenters claimed to have experienced difficulties obtaining from the MMS a copy of the EIS or the information necessary to make meaningful comments and to respond to the perceived legal and technical flaws in the proposal. One commenter contended that preparation of the document is not a freely open process but one in which information is carefully and tightly controlled, contrary to the spirit and intent of NEPA, OCSLA, and FOIA. The commenter, therefore, requested an extension of the comment period.

Some commenters argued that the draft EIS failed to address the issues previously raised by State and local government agencies on the preparation of the EIS and on the Draft Proposed Program. A few commenters felt that their comments were ignored. A commenter requested that his comments be summarized and published in a supplemental document.

A few other commenters requested that prior to any leasing an outside agency such as NOAA prepare an EIS on the Santa Maria Basin and on the impacts of seismic testing on marine resources.

b. Issue Was Raised by

League Of Women Voters, Santa Barbara, California, Hannah; State Of California, Washington Office Of The Governor, Wilson; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of Monterey, California, Board Of Supervisors, Kauffman; County Of Monterey, California, Planning And Building Inspection Dept., Maki; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Cook Inlet Vigil, Alaska, Balkus; Environmental Defense Center, California, Chytilo; Friends Of The Earth, Nelson; Greenpeace, Washington, D.C., Alexander; Kodiak Environmental Network, Alaska, Stahl-Johnson; League Of Women Voters, California, Fuller; League Of Women Voters, Ventura County, California, Fellows; Ocean Sanctuary Coalition, San Luis Obispo, Kranzdorf; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, National OCS Subcommittee, Taylor; Bailey; Brown; Evans; Mc Grath; Miller; Nelson; Potter; Riggins; Sterios; Stevens & 48 Signatories; Watts; Wikholm; Wolf; Wright; Anchorage, AK Public Hearing, Testimony; Houston, TX Public Hearing, Testimony; New

Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony; Wilmington, NC Public Hearing, Testimony.

c. Response to Issue

The public review process for the draft EIS was conducted in compliance with CEQ regulations and the Department of the Interior's own guidelines. A diligent effort was made to involve the general public in the NEPA review process through public hearings and the solicitation of written comments. In addition to the required *Federal Register* Notice announcing the times and locations of the public hearings and requesting comments, notices were sent to the media and interested parties.

Because the focus of the draft EIS covered broad geographical areas, it was difficult to select hearing dates, times and locations which were convenient to all interested parties. The number and locations for the public hearings were, therefore, tailored to the areas under consideration for leasing in the Proposed Comprehensive Program and those areas which may be most affected by potential development. The times for each hearing and size of the facility were based on the public's attendance at past hearings.

Concerning the comments about the public hearing in Santa Maria, California, a concerted effort was made to provide a reasonable opportunity for the public to provide comments on the draft EIS. The facility selected was the largest available at the time. Based on the number of people who preregistered to testify (130 individuals), the facility was assumed to be adequate. The large turnout (about 1,800 individuals) was unexpected. The hearing was open for more than 10 hours during which time nearly 100 people testified, including individuals from outside the local area. More people were prevented from testifying in part by the disruptive behavior of many of those in attendance. To guarantee that the public was aware that they could communicate their views and concerns in writing, announcements were made at the hearing that written comments would be accepted until October 29, 1991. The public was assured that all written and oral comments are given the same consideration in the preparation of the final EIS.

Public meetings were also held in the Alaska, Atlantic, and Pacific OCS Regions to provide the public and local officials information about the proposed program and to allow individuals to express their concerns.

Regarding comments about the format and size of the document, the EIS presents a program-level assessment of the potential environmental effects of holding 23 lease sales in 12 of the 26 OCS planning area. Many of the environmental resources cross planning areas. Therefore, a regional approach was used in preparing sections of the draft EIS. This reduced the extremely complex nature of the document and prevented the fragmentation of the analysis of specific environmental resources and issues. The analysis focuses on each environmental resource in a single, coherent section. The analyses of migratory species that cross regional boundaries were further consolidated into discrete sections.

The MMS has attempted to reduce the size of the program EIS by eliminating redundancy and unnecessary descriptive material and by organizing the document so that important analytic material, such as the generic discussions in Section IV.A., can be referenced in subsequent sections and not repeated. However, we have also had to be responsive to the many recommendations during scoping and the draft EIS review that more issues and alternatives, and greater detailed analyses be added to the document. The final EIS strikes an appropriate balance while meeting the intent of NEPA.

To help the reader locate a specific discussion, a label was placed at the bottom of each page indicating which region, environmental resource, section, or analytic case was presented on that page. Because the document already had been formatted based on a regional approach, the preparation of regional booklets is not necessary. However, the Table of Contents and Index have been expanded to assist the reader in locating information on specific regions.

We disagree with the comment that the preparation of the draft EIS was not a freely open process. The process for preparation of the draft EIS described in Section V.B. complies fully with CEQ regulations. Commenters' claims to have experienced difficulties obtaining information are unfounded. The information cited in the EIS or incorporated by reference was reasonably available for inspection by interested individuals within the 90-day comment period either at the MMS offices or through the interlibrary loan service of their local libraries.

The public review period of the draft EIS which exceeded the requirements of both CEQ regulations (minimum 45-day comment period) and the Department of the Interior's manual (60-day comment period) allowed sufficient time for interested parties to review the material. Therefore, no extensions were necessary. The commenter requesting additional information from the Pacific Region was given the opportunity to copy the material requested in that office. Another commenter was provided materials, as well as given local sources of the requested documents.

Every attempt was made to be sure that the draft EIS was widely available for the review. The EIS was distributed in a timely manner to Federal, State and local agencies, and public interest groups. Copies of the draft EIS were available for review in public libraries located throughout the coastal States. Information regarding the locations of the libraries was available from the regional offices. Limited number of copies were also available from the headquarters and regional offices.

Concerning comments that MMS was not responsive to scoping recommendations, all comments received in response to the Notice of Intent to Prepare an EIS and those on the Draft Proposed Program were evaluated in preparing the scope of the EIS (Section I.B). It is, therefore, not necessary to prepare a supplemental document which would duplicate the information in Section I.B. The scoping process required by NEPA determines the appropriate content of the EIS. As part of this process, determinations are made about which environmental issues and reasonable alternatives should be analyzed in detail in the EIS. Many of the comments received were within the scope of the programmatic EIS. Those comments helped to form the issues and alternatives analyzed in the EIS, and they are summarized, along with comments considered outside the scope of a programmatic EIS, in Section I.B. Some comments, which were not relevant to preparation of the EIS, were not considered in the scoping process.

The NEPA requires (15 CFR 1502.3) that an EIS be prepared by the responsible Federal official. An outside agency such as NOAA does not have "jurisdiction by law" or the authority to make decisions concerning leasing in the Santa Maria Basin or to prepare an EIS on seismic activity associated with oil and gas exploration. Under the OCS Lands Act, as amended the Secretary of the Interior is responsible for administering mineral exploration and development on the OCS. The Secretary of the Interior designated the MMS as the administrative agency responsible for leasing and supervising the exploration, development and production of minerals resources on the OCS. The MMS, therefore, has the overall responsibility to prepare EISs concerning leasing, exploration, and development of mineral resources on the OCS.

ISSUE 2. Analysis Does Not Meet National Environmental Policy Act (NEPA) Requirements.

a. Definition of Issue

Some comments were received which suggest that the draft EIS does not meet all of the NEPA requirements. One segment of these comments was very broad in scope. It included opinions that the draft EIS is "not in compliance" or is "inadequate." Other comments advised that the draft EIS does not take a "hard look" at potential impacts, or that the impact analyses are not rational, objective, or scientific. Among the comments that are somewhat more specific were contentions that "secondary" impacts were not addressed, analytical methods were not described, information sources were not cited, and impact "magnitude" was not presented.

b. Issue Was Raised by

State Of California, Washington Office Of The Governor, Wilson; City Of Morro Bay, California, Mayor, Sheetz; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Environmental Center, San Luis Obispo County, California, Kupper; Friends Of The Earth, Northwest Office, Nelson; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Gulf Breeze, FL Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The Department of the Interior (USDOI) believes that the EIS is in full compliance with NEPA and the implementing regulations. The EIS fully describes the proposal and its potential impacts (see Sections II and IV.D). The impacts of the proposal are also evaluated in the context of potential cumulative impacts (see Section IV.D.1.c). The EIS identifies and evaluates a broad range of reasonable alternatives to the proposal including a “no-program” alternative. In addition, the potential impacts of the alternatives are presented in a comparative manner in order to aid decisions to choose among them. Finally, the EIS incorporates and considers all the available information that is relevant to assessing the potential impacts.

A definition of the term “secondary” impact was not offered in the comments. However, a secondary impact is commonly considered to be an impact caused by another impact, rather than one resulting directly from a specific human activity. For example, an accidental oil spill may degrade the quality of bird habitat without actually oiling any birds. If bird reproduction rates are diminished because of the degraded habitat, this impact would be considered a secondary impact of the oil spill. As another example, demands for labor to conduct offshore drilling and development activities may cause an increase in a nearby coastal population. A secondary effect of this population increase could be an increased demand for public facilities, such as schools. The EIS does acknowledge, either explicitly or implicitly many types of secondary impacts. Although the nature of secondary impacts usually can be identified, any expressions of their magnitude would be so speculative that they would not provide reasonable bases for decision making. In large part, this is due to the fact that the precise location and intensity of activities that will result from implementing the proposal are very speculative.

Hundreds of sources were used to develop the EIS. Specific references were cited for all technical information used in the analysis that is not considered to be common knowledge. Additional citations have been added to the final EIS, and Chapter VI (References) has been reviewed and, where appropriate, revised to ensure that the list is complete and accurate. Also, see the response for Issue 8 which relates to information use.

A description of the methods used to prepare the analysis is covered in Sections IV.A (which presents the structure and format for the analysis) and IV.D.1.a (which presents the basic assumptions used to drive the analysis) of the EIS. An explanation of the general process used to develop a specific analysis is included in the response for Issue 3.

The magnitude of expected impacts is incorporated into the conclusion statements presented for each analysis. Impact magnitude is expressed in various ways and depends on the environmental resource being analyzed. For example, the magnitude of impacts on biological resources is commonly expressed in terms of the number of individual organisms affected or the percent of a population affected, whether impacts are lethal or sublethal or the amount of time needed for organisms or populations to recover to pre-impact levels. Magnitude (defined as greatness in size or extent) is also expressed in terms of the areal extent (such as acres) of the impact on certain resources or the size of the change in population or employment in a region.

Concerns about the adequacy of the analysis for a specific environmental resource covered by the EIS are addressed elsewhere in this section in the issue summary and response for the specific resource. Refer to Issues 22 through 43.

ISSUE 3. Analysis and Conclusions Are Not Valid.

a. Definition of Issue

Two general types of comments on the draft EIS related to the validity of the conclusions about potential impacts. First, questions were raised about the methods used to develop the analyses. Second, concerns were expressed that the conclusions presented lacked support from the analysis. For example, some comments suggested that more data should be included in the analysis. Others suggested that impacts presented in the analysis are more severe that those included in the conclusions. In addition, to these general comments about the validity of analyses and conclusions, other comments were received that apply to specific analyses presented in the EIS.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders; Assoc. Of Monterey Bay Area Governments, California, Nunn; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; North Slope Borough, Alaska, Mayor, Kaleak; Greenpeace, Washington, D.C., Alexander; Kodiak Environmental Network, Alaska, Stahl-Johnson; League Of Women Voters, Oregon, Eaton/ Cottingham; Natural Resources Defense Council, Technical Review Panel, Wald; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Anchorage, AK Public Hearing, Testimony.

c. Response to Issue

The method used to develop each analysis contained in the EIS includes five basic steps. First, the types of OCS activities known or suspected to affect the environmental, economic, or social resource being analyzed are identified. Second, the scenario of activity hypothesized to result from implementing the proposal (or alternative) is reviewed and specific activities (including assumed accidents) that may cause impacts are noted. Third, assumptions are made about the degree to which the resource would be exposed to the activities because it was not provided as part of the hypothetical scenario. Assumptions about exposure are based on information available on the distribution of the resource and the times and locations of hypothesized future activities. Fourth, findings of available field and laboratory research on impacts of similar or applicable exposures are documented. Fifth, professional judgement is used to estimate the nature and degree of impact expected from the hypothesized activities.

The method of analysis used for the EIS is a reasonable and logical blending of information on resource distribution and sensitivity, and projections of future activities that could result from implementing the proposal. Analyses presented in the EIS consider all relevant, available information about potential impacts of OCS activities and other activities that may contribute to cumulative impacts. In some cases, additional information identified in comments has been incorporated into the final EIS. Information regarding the analysis and conclusions for a specific environmental resource may also be found elsewhere in this section within the response to comments on that resource.

The conclusion statements presented in the EIS for the proposal and alternatives are the impacts expected from the hypothetical scenarios used to characterize future program-related activities. Actual impacts may be different from those stated in the conclusions if future activities or environmental resource exposures to those activities are different from those hypothesized. When impact estimates cannot be expressed precisely, a range of outcomes is often presented in the conclusion. Some of the analyses include descriptions of impacts that could result if exposures were more severe than those assumed for purposes of drawing conclusions. These "what-if" discussions may be the basis for comments which assert that the conclusions understate the severity of impacts presented in the analysis. Although information of this nature was included to ensure that all conceivable impacts were covered by the analysis, it was not considered a reasonable basis for drawing conclusions about expected impacts. Thus, no conclusion understates or misrepresents the expected, scenario-specific impacts identified in the supporting analysis.

For responses to concerns that are specific to the analysis and conclusion for a specific environmental resources, refer to the issue number that pertains to that resource.

ISSUE 4. The EIS Scope and/or Assumptions Are Improper.

a. Definition of Issue

(1) The Scope of The EIS Is Too Narrow.

Commenters suggested that the analysis in the EIS for the Pacific Region should focus on the Santa Maria Basin and the Santa Barbara Channel. It was recommended that the discussion for the Santa Maria Basin should include a description of the oceanographic features, quality of the marine waters, seasonal upwelling, onshore and offshore geography, meteorology, seismic testing and wetlands.

A commenter suggested that the EIS discuss each bioregion (subregion) in Alaska separately to take into consideration the differences in the climatological variances which range from temperate to Arctic.

Many commenters requested additional environmental resources, issues, or impact producing factors be added and analyzed in the EIS. Specifically requested were the following: plankton, the Choctawhatchee beach mouse, seismic testing effects on fishing or sea mammals, an extensive study of offshore faults in Southern California, socioeconomic impacts associated with an oil and gas boom bust cycle, health and air quality, health and human safety from accidental events, environmental damage, visual resources and tourism, onshore solid waste disposal, specific archaeological sites and an oil spill clean up plan.

A commenter requested a more detailed map depicting the area under consideration for lease in the Southern California Planning.

(2) The Assumptions in the EIS Are Highly Questionable and the Basis for the Assumptions Needs Explanation.

Some commenters argued that the assumptions in the EIS were highly questionable and were purely speculative.

Commenters noted that the caps (limits on lease sale size) proposed in the SID were not analyzed in the draft EIS.

Several commenters suggested the EIS explain the basis for the following specific assumptions:

- The level of infrastructure in the Central Gulf of Mexico differs significantly from the Western Gulf of Mexico. This discrepancy should be explained.
- For the cumulative case, the EIS should note the total activity assumed (the proposal plus ongoing activity or activity based on previous leasing).
- A question was raised about whether the planning horizon associated with this five year plan was a chronological five years or the life time of the leases that results from this plan. There was also some confusion on the different time periods given for the activities under the proposed plan. The commenter indicated they ranged from 13 to 49 years.

- Spill predictions should be discussed in the Oil Spill Assumptions Section of the cumulative case for other activities.
- The EIS understates the effects of the proposed program by ignoring the fact that the Alaska OCS oil will be delivered by tanker.
- Assumptions presented in the EIS state that tanker spills will occur as a result of the program in Alaska, but not in the Southern California Planning Area. The EIS should present a complete explanation of the assumptions and rationale used to arrive at the assumptions.
- A few commenters questioned why particular locations for the 100,000 bbl spill in the Pacific Region and the 1,000,000 bbl in the Alaska Region were chosen when other areas are just as sensitive. They also suggested that the scenario for the spill was chosen so impacts would be less. Another commenter requested a similar scenario for the Arctic.
- A full description of the base and high case assumptions for the Atlantic Region was requested. A commenter questioned the discrepancies between the scenario in the draft EIS and that described for Mobil's exploration plan and that the Morehead City Port facility was adequate to handle the petroleum industry support needs.
- The basis for assuming that 75 percent of the volume of any oil spill will be lost prior to the time that it contacts the Gulf of Mexico coast was requested.
- The assumption that the Beaufort Sea causeways will be no longer than 2500 feet should be explained.
- Commenters questioned the assumption that spills occur with uniform frequency.
- The EIS should assume the construction of a pipeline in the Arctic to transport crude oil to the Trans-Alaskan Pipeline System.

(3) The Exploration and Development Assumptions for Southern California in the EIS Are Questionable.

The assumptions that existing onshore facilities in Southern California would be used for oil and gas activity in the Santa Maria Basin and that no new facilities or pipelines would be needed were considered by many commenters to be inaccurate and highly unlikely. There are no existing processing or transportation facilities in San Luis Obispo County. Commenters stated that onshore facilities will be required to support development in the northern Santa Maria area. Commenters requested that the basis for these assumptions be clearly explained and an analysis supporting the assumptions be presented. Some commenters suggested that a review of the process by which these assumptions are developed be completed.

Commenters requested the following clarification or explanation of particular aspects of the assumptions:

- Commenters argued that because the assumptions concerning onshore support facilities are incorrect, the analysis in the EIS is erroneous. Therefore, none of the impacts associated with onshore facilities and pipelines were analyzed. For example, extending the life of existing or assumed to be existing onshore facilities will result in environmental impacts beyond the facilities' projected life of 15 to 25 years. The ability of the "existing facilities" to handle the additional production should be documented or the EIS must be revised to address these concerns.
- Clarification of the assumptions for the cumulative case (Tables (IV.D.1.c-2 and IV.D.1.c-3) as to whether the assumptions include new or total (existing plus new) facilities.

- Commenters requested an explanation of the assumption in the cumulative case for a pipeline to be constructed to shore in the Northern Santa Maria Basin. The EIS should explain why a pipeline was not assumed in the base case, and an analysis of impacts which would result from the landfall must be discussed in all prior and subsequent sections.

- A commenter argued that tanker spills would occur closer than 50 miles from shore in the Pacific Region.

- Commenters questioned the assumption that Morro Bay is the northern limit of the effect of a pipeline spill.

- Commenters questioned the assumption in the Southern California Planning Area that oil will not enter steelhead streams or marshes.

- Commenters asked whether the reference to onshore facilities includes marine terminals as well as onshore pipelines. The EIS should explicitly state whether the use of tankers (from marine terminals) is assumed and should detail the resulting risk of oil spills.

- Commenters argued that the EIS underestimates the potential oil spills that may result from the proposed leasing activity in Southern California by assuming that pipelines, rather than tankers, will be used to transport produced oil.

- Commenters suggested that the EIS address cumulative impacts with respect to the availability of refineries and processing facilities to process the high-sulfur crude oil expected to be found in the northern Santa Maria Basin. The EIS omits the possibility of export tankering to Japan or the Gulf of Mexico.

(4) The EIS Does Not Demonstrate that the Proposed Comprehensive Program Complies with the OCS Lands Act.

Many comments on the draft EIS indicated a need to examine the factors and processes used to reach decisions about the proposed program. Most relate to requirements of the OCS Lands Act for developing the proposed program. Among the specific concerns about compliance with the OCS Lands Act are that the EIS does not demonstrate that the proposed program is properly balanced and does not consider an equitable sharing of developmental benefits and environmental risks. Other comments also suggest that the EIS must show the criteria and processes used to gather information used for decision making, evaluate information on marine productivity and environmental sensitivity, determine planning area boundaries, establish leasing "caps," and identify program alternatives.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Smith; U.S. Dept. Of The Interior, National Park Service, Galvin; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; Commonwealth Of Virginia, Council On The Environment, Buttleman; Exxon Company, USA, Tibbitts; Port San Luis Harbor District, California, Moffitt; San Luis Obispo County Planning Dept., California, Euphrat; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of California, Department Of Transportation, Joseph; State Of California, South Coast Air Quality Mgmt. District, Greenwald; State Of California, State Lands Commission, Sanders; State Of California, Washington Office Of The Governor, Wilson; State Of Florida, Dept. Of Environmental Regulation, Latch; State Of Florida, Office Of The Governor, Chiles; State Of Louisiana, Department Of Natural Resources, Swan; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; Assoc. Of Monterey Bay Area Governments, California, Nunn; City Of El Segundo, California, Morries; City Of Laguna Beach, California, Mayor, Fitzpatrick; City Of Morro Bay, California, Mayor, Sheetz; City Of Santa Barbara, California, Brown; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Air Pollution Control District, Carr; County Of San Luis Obispo, California, Board Of Supervisors, Blakely;

County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; County Of Santa Cruz, California, Board Of Supervisors, Keeley; County Of Ventura, California, Resource Management Agency, Berg; Hampton Roads Planning District Comm., Virginia, Collins; North Slope Borough, Alaska, Mayor, Kaleak; Port San Luis Harbor District, CA, Board Of Commissioners, Leane; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; American Lung Association, Monterey, Santa Cruz, San Luis Obispo, Stecher; Audubon Society, Mobile Bay, Alabama, Jones; Coalition To Restore Coastal Louisiana, Kemp; Environmental Center, San Luis Obispo County, California, Kupper; Greenpeace, Washington, D.C., Alexander; League Of Women Voters, California, Fuller; League Of Women Voters, Oregon, Eaton/Cottingham; Natural Resources Defense Council, Technical Review Panel, Wald; Project Reefkeeper, Operations Center, Lamberta/Stone; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, National OCS Subcommittee, Taylor; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Adams; Chandler; Panetta; Pedrick; Perry; Smith; Stevens & 48 Signatories; Weiss; Anchorage, AK Public Hearing, Testimony; Houston, TX Public Hearing, Testimony; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony; Wilmington, NC Public Hearing, Testimony.

c. Response to Issue

(1) The Scope of the EIS Is Too Narrow.

The scope of the EIS focuses on the area(s) of the environment that are likely to be affected by the proposed action. The areas chosen for analysis are based on whether they could be affected by the activities associated with the scenario developed for the proposed program. Although a regional approach is used in preparing the EIS, Chapter III — Affected Environment does include a description of the Santa Maria Basin and the Santa Barbara Channel. Chapter III also describes the characteristics suggested by commenters. Where appropriate, the discussions on the Santa Maria Basin and Santa Barbara Channel were expanded. However, the degree of specificity is determined by the nature of the proposal.

The EIS presents a program-level assessment of the potential environmental effects of implementing a nationwide oil and gas leasing program on the OCS. At the programmatic stage, broad regional EISs are appropriate (see CEQ regulations at 40 CFR 1502.20 and 1508.28). These EISs, such as this document, provide relevant information for the adoption of national programs. More specific EISs are prepared for subsequent actions, narrowing the scope of the EIS and focusing on the issues ripe for decision. A sufficient level of detail in the EIS exists for the Secretary to make a decision at the programmatic stage. It is, therefore, not necessary to refocus the EIS on the Santa Maria Basin and Santa Barbara Channel, separately.

The analysis in the EIS for all regions, including the Alaska Region, is presented by affected resource, not by geographic area. This approach allows for the most direct comparison of the impacts to the resources and issues of concern. Each analysis begins with a brief summary of the distribution and current status of the resources. This takes into consideration any environmental factor such as climatological variances which could affect the analysis. For example, the migratory route of the gray whale ranges from the Arctic to Mexico. Therefore, the analysis takes into account the broad range of climatological conditions and not just those associated with the three Alaskan subregions.

Many commenters requested additional environmental resources, issues, or impact producing factors be added and analyzed in the EIS. Based on these comments, determinations were made about which environmental issues or impact producing factors should be evaluated in the EIS (see Section I.B). A brief summary is presented below:

As with the draft EIS, plankton is not discussed in a discrete section of the final EIS. Impacts on plankton are evaluated as part of the analysis for larger organisms that use plankton as food (see Section III.B.2.a and IV.D.1.a.(3)(b) the bowhead whale), or as part of the analysis for other organisms that may be planktonic during some portion of their life cycle (see Section IV.D.1.a(6) fish resources).

The Choctawhatchee beach mouse has been added to the analysis (see Section IV.D.1.a(4)).

Seismic testing effects on fishing or marine mammals are not included in a separate section of the EIS. The potential effects from seismic testing are evaluated as part of the analysis for marine mammals and fish resources (See Sections IV.D.1.a(3) and IV.D.1.a(6), respectively).

An extensive study of offshore faults in Southern California is not necessary at the programmatic stage. Geologic hazards are discussed in a regional sense. The level of detail requested is most appropriately done at the exploration and development stage when a specific location and type of operation are proposed (See response to Issue 18).

To address the impacts associated with an oil and gas boom bust cycle in the Gulf of Mexico, the socioeconomic section in the EIS has been expanded to include a section on Public Services and Infrastructure and a section on Social Patterns (See Sections III.A.3 and IV.D.1.a(10)(a)). Also, a section has been added regarding the oil and gas boom bust cycle to the Secretarial Issue Document for the Proposed Final Program.

It is not necessary to address worker safety in this EIS because the issue focuses on specific activities and environmental conditions associated with the development of a lease. The CEQ regulations encourage Federal agencies to focus EIS's "on the actual issues ripe for decision at each level of environmental review" (40 CFR 1502.20). The worker safety issue is not associated with the purpose of the proposed program to make decisions about the size, timing, and location of future leasing (see Section I.B). Impacts related to human safety are addressed during the review of individual lease exploration and development proposals. The MMS regulations for conducting operations on those leases (30 CFR 250.20), require the lessee to perform all operations in a safe and workmanlike manner, to maintain all equipment in a safe condition for the protection of the lease and associated facilities, and the health and safety of all persons. The lessee also shall immediately take all necessary precautions to control, remove, or otherwise correct health, safety, or fire hazard.

The EIS has been revised to address the effects of drilling discharges from offshore activities being disposed onshore (See Section IV.A.1.b).

The identification of specific archaeological sites is not necessary at the programmatic stage. The level of detail requested is most appropriately done at the exploration and development stage when the specific location and type of operation are proposed. For example at the exploration phase, existing Federal regulations (including MMS (30 CFR Part 250)) require the operator to submit archaeological and cultural resource information (including any cultural resource reports or survey information required by the Regional Supervisor) located within the area that may be disturbed by the proposed activities. At that time, archaeological resources will be located, evaluated, and mitigated prior to any offshore operation.

A separate analysis of an oil cleanup plan is not included in the EIS because the potential effects from cleanup operations are discussed as part of the analysis for the environmental resources (See Sections IV.D.1.a(3) and IV.D.1.a(4)). Also contained in the EIS is a section on Oil Spill Response Capabilities (See Appendix D).

To help orient the reader of the EIS, large maps of the four OCS Regions have been prepared and will be distributed with the final EIS. The maps depict general information in the offshore and coastal areas potentially affected by the proposed program. The maps also delineate OCS areas currently under lease as well as the areas being considered for lease in the proposed program.

(2) The Assumptions in the EIS Are Highly Questionable and the Basis for the Assumptions Needs Explanation.

We disagree that the assumptions in the EIS are highly questionable and purely speculative. The hypothetical scenarios concerning exploration and development activity were developed based on existing conditions in each region. Some of the major factors which are taken into consideration in the development of the scenarios are: a) estimates of the amount of hydrocarbons which might be discovered, leased, and developed, b) historical information on exploration, development, and production in the region, c) the presence of oil and gas infrastructure and facilities, d) available geologic, engineering, and economic information, e) geographic location of the area, and f) existing transportation networks and markets. Using these factors reasonable assumptions concerning the level of exploration, development, and production of hydrocarbons are made (see Section IV.D.1.a). At the program stage, there is no basis for making more than general assumptions concerning potential development as a result of the proposed schedule of sales. At each subsequent stage of the leasing and development process, more specific environmental documents will be prepared.

The proposed caps outlined in the SID were analyzed in the draft EIS. The scenario analyzed in the EIS is derived from the amount of resources assumed to be leased and developed which is based on the size of the areas to be considered for lease at the Area Identification stage.

One of the major factors in determining the level of infrastructure required to develop the hydrocarbon resources within a planning area is the amount of resources assumed to be leased and developed as a result of the proposed program. In the Western Gulf 0.86 BBOE is assumed to be leased, discovered, and developed compared to 1.58 BBOE for the Central Gulf. Taking the resource estimate and other factors (see above) into consideration, the level of infrastructure required would, therefore, be less in the Western Gulf.

The cumulative analysis in the EIS considers impacts to the environment when the proposed action is added to past, present, and reasonably foreseeable future actions or activities. The past, present, and future actions or proposals have been divided into two categories: non-OCS and OCS (see Section IV.D.1.c). The proposal plus ongoing activity or activity based on previous OCS leasing activity is contained in the analysis of OCS projects and proposals.

The "planning horizon" for the proposed program is from 1992 to 1997. However, the analysis in the EIS considers the impacts to the environment over the period of time needed to explore, develop, and produce all the hydrocarbons assumed to be leased. This period of activity ranges from approximately 20 to 45 years. The periods of activity can vary between the planning areas and from one type of activity to another (See Figures IV.D.1.a-1 through IV.D.1.a-11). Where appropriate the time frames were corrected.

To prevent any confusion, the assumptions concerning OCS and non-OCS activities or proposals were divided into two subsections. OCS oil spill assumptions include present and future OCS production and transportation of OCS crude oil. Non-OCS oil spill assumptions were placed under the discussion of the non-OCS activity or proposal considered in the cumulative analysis.

The EIS does take into consideration the transportation of oil from Alaska to west coast ports (Puget Sound, Washington, San Francisco, and Los Angeles, California) (see Section IV.D.1.a). Table IV.D.1.a-6 presents the location and number of oil spills expected to occur as a result of this tanker transportation, and the affected resources are analyzed in the appropriate sections of Chapter IV.

The assumptions whether to use pipelines, barges, or tankers to transport OCS natural gas and oil to shore take into consideration technological constraints, environmental preferences, and economic considerations. Where it is environmentally sound, technologically feasible, and economically practical pipelines are used. Currently, there is existing infrastructure in some of the planning areas which would support the use of pipelines to transport the crude oil to shore. However, in the Alaskan

Planning areas where no oil and gas infrastructure exists, tankers were assumed. The scenarios analyzed in the EIS take into account the assumption that oil produced in the Southern California Planning Area will be transported by pipeline and Alaskan OCS oil will be transported by tanker. Regarding the comment about oil spill assumptions, the scenario for the base case analysis included the assumption that one tanker spill of Alaska OCS oil will occur in southern California (see Table IV.D.1.a-6).

Although unrelated to activities associated with OCS oil and gas production, several large petroleum spills have occurred in the coastal waters of the United States. To provide a range of potential impacts associated with oil spills, a high impact, low probability event was analyzed in the EIS for each region except the Atlantic where a gas well blowout is assumed. The risk to the various resources in a region will vary depending on the location and circumstances of the spill. The location, time, and climatic and oceanographic conditions assumed in the scenario for each large spill were selected in order to pose serious adverse effects to many of the resources within the region.

A full description of the base and high case assumptions for the Atlantic Region is provided in Sections IV.D.1.a and IV.D.1.b. At the program stage, there is no basis for making more than general assumptions about the types of activities that may result from the adoption of the proposed action. At each subsequent stage of the leasing and development process, more specific environmental documents will be prepared. Discrepancies can exist between the scenarios in the EIS and specific exploration (such as the Mobil exploration plan) and development plans. Scenarios for exploration and development plans are developed based on actual activities proposed by the operators on the lease and are specific to that tract.

Although not specifically described in the assumption section of the EIS, information provided in the scenario about some activities may have been extrapolated to form additional assumptions about the interaction between the activities and the environmental resource. These specific assumptions are presented in the analysis for the resource. For example, the assumption was made that the Morehead City Port facility would be used to support development and production activities. This was based on existing docking space, transportation and land use plans and the location of the port facility to proposed OCS activity.

The type of crude oil likely to be produced is the basis for the assumption that 75 percent of the volume of oil spilled will be lost prior to the time that it contacts the Gulf of Mexico coast. It is assumed that the oil spilled will have characteristics similar to Louisiana crude (a light, very low asphaltene oil). Louisiana crude disperses and degrades rapidly due to the influences of the Gulf's warm climatic conditions and the properties of the oil. Usually within a few days most of the spilled oil has dissipated.

The causeways included in the scenario in the Beaufort Sea are associated with pipeline construction, not docking facilities. The shorter causeways (2,500 feet) analyzed in the EIS are used to mitigate the potential impacts associated with permafrost at offshore pipeline landfalls.

The distribution of oil spills uniformly over time was selected rather than one based on an arbitrary distribution because there is no statistical evidence that spills are more likely to occur during a particular season or a specific phase of production.

The EIS does discuss the potential impacts associated with the construction of overland pipelines which would interconnect with the Trans-Alaska Pipeline System (TAPS) (see Sections IV.D.1.a and IV.D.1.a.(4)(b)).

(3) The Exploration and Development Assumptions for Southern California in the EIS Are Questionable.

We disagree that the hypothetical scenarios concerning exploration and development activity in Southern California are inaccurate and highly unlikely. Although it is true that currently there are no existing processing or transportation facilities in San Luis Obispo County, this is only one of the factors used in developing the scenario for the Southern California Planning Area. Numerous factors must be evaluated when developing exploration and development scenarios, particularly in areas with existing or proposed hydrocarbon development (See previous response). For example, some of the major factors considered in developing the scenario for Southern California were the present capacities of existing hydrocarbon infrastructure and facilities and transportation networks, any proposed infrastructure or facility expected to be in place by the time exploration and development occurred from the proposed program, and the consideration of local land use policies (in particular, the desire for the consolidation of onshore facilities).

The MMS reviewed existing oil and gas infrastructure and facilities and plans of development (such as, Point Pedernales — Platform Julius Project and the Point Arguello Project) for the area, and determined that the existing and proposed facilities could accommodate the development of the conditional resources identified for the base case analysis. For example, the existing Point Arguello onshore processing facility has an approved design capacity of 250,00 bbl of crude oil per day. However, it is currently only processing approximately 100,000 bbl per day. This excess capacity plus future production declines will be sufficient to accommodate any new production from the proposal.

Where appropriate, the analysis in the EIS has been modified to take into consideration the impacts associated with the possible extension of life of existing facilities.

Tables IV.D.1.c-2 and IV.D.1.c-3 present new infrastructure required to develop reserves and leased and unleased resources. These figures include infrastructure needed for proposed plans of exploration and development, leases resulting from the Proposed Comprehensive Program, and in some cases, future 5-year programs (see assumptions Section IV.D.1.c). A brief description of the currently existing oil and gas infrastructure is presented in IV.D.1.c.

The assumption in the cumulative case for a pipeline to be constructed to shore from the northern Santa Maria basin is based on the potential development associated with existing leases and plans of development. The pipeline scenario in the base case assumed that a pipeline network would be in place by the time development occurred from the proposed program, and that the pipelines associated with the seven new platforms would tie into that network. A pipeline landfall associated with the development of the 87 tracts would be required only if a pipeline to shore was not built to develop the existing reserves.

We agree that tanker spills could occur closer than 50 miles from shore in the Pacific Region. However, the particular assumption in question was specific to an Alaskan tanker spill offshore the Northern California Planning Area. This assumption is based on the transportation route used by tankers to transport crude oil from Alaska to west coast ports. In general, tankers take the most direct route between ports. The route between Alaskan and west coast ports is located more than 50 miles offshore northern California. Therefore, the location of the spill assumed for the analysis in the Northern California Planning Area is probably closer to shore than the tankers that would carry OCS oil from Alaska.

The assumption that Morro Bay is the northernmost limit of the effect of a pipeline spill was based on several factors: 1) the assumed location of the pipeline network, 2) the assumed size of the pipeline spill (7,000 bbl), and 3) the assumed location where the oil spill would contact shore. It was estimated from a model developed by Ford and Bonnell (1987) that a spill of approximately 7,000 bbl to 10,000 bbl in size could oil 30 kilometers of coastline. Based on the assumption that the pipeline network was south of Morro Bay, the spill was assumed to contact the shoreline along a 30 kilometer stretch extending between the Santa Maria River and Point Buchon. It was therefore, not assumed that the effects of such a spill would be found north of the bay.

The commenter misinterpreted the statement ". . . there was a limited chance of oil entering a steelhead stream." Steelhead spawning streams and marshes in southern California are in general, small. The relative small size of the openings permits oil spill cleanup procedures, such as diking, in addition to booming, and double booming (see Appendix D), to be effective in preventing oil from entering them. Therefore, there is a limited chance that oil would enter them.

The reference to onshore facilities does not include marine terminals. It is assumed that the crude oil from the Santa Barbara Channel/Santa Maria Basin would be transported by overland pipeline to refineries (see Section IV.D.1.c) in the Los Angeles, California area.

The assumption to use pipelines to transport hydrocarbons to shore in southern California was based on 1) the current and proposed transportation networks offshore Southern California, 2) the environmental preference of transporting crude oil by pipeline, and 3) technological and economic considerations for the area. Also taken into consideration was the strong preference by local governments for hydrocarbons to be transported by pipelines.

At the programmatic level, only broad assumptions can be made concerning the availability of refineries and facilities to process the hydrocarbons. Only general assumptions concerning the existing transportation networks and potential markets are made. These are based on the location of existing or assumed to be in place processing facilities, and the localities that are currently accepting deliveries of Southern California crude. The oil currently being produced is either exported to Texas (Gulf of Mexico Region) or the Los Angeles area for refining. For the purpose of this analysis, it was assumed that the Los Angeles markets would be able to handle the hydrocarbons discovered and produced as a result of the proposed program. This is based partially on future declines in existing production in the area. Exporting hydrocarbons to Japan would not be a reasonable assumption. Before any oil or gas may be exported under the requirements and provisions of the Export Administration Act of 1969, the President shall make and publish an express finding that such exports will not increase the country's reliance on imported oil or gas and are in the national interest.

(4) The EIS Does Not Demonstrate that the Proposed Comprehensive Program Complies with the OCS Lands Act.

The EIS is not intended to be the record of all the information and processes used to reach decisions on the proposed program. Rather, it represents one source of information that must be considered in the decision making process. The EIS was developed to meet the requirements of the National Environmental Policy Act (NEPA) and the NEPA-related provisions of the OCS Lands Act. The use of information from the EIS and other information is recorded in the Secretarial Issue Document (SID). The SID was made available for public review with the proposed program (see 56 *FR* 36834; August 1, 1991). This final EIS and a SID for the proposed final program will be issued in April 1, 1992.

The procedures and criteria used to develop the EIS are included in this document. In particular, see the discussions in Chapter I (on gathering information for the EIS) and in this section for Issues 3 (on analytical method), 13, and 14 (on identifying reasonable alternatives). Refer to the SID for information on development of the proposed program, balancing program benefits with costs, and consideration of relative environmental sensitivity and productivity.

ISSUE 5. The Draft EIS Analysis Is Inconsistent Among Regions and Planning Areas.

a. Definition of Issue

A commenter stated that conclusions for a particular resource (e.g. water quality) appeared to use contradictory information or assumptions for different regions.

A commenter indicated that the discussion in Section IV.E. Unavoidable Adverse Environmental Effects, Section IV.F. Relationship Between Short-Term Uses of Man's Environment and the Maintenance and Enhancement of Long-Term Productivity, and Section IV.G. Irreversible and Irretrievable Commitments of Resources should be specific to each region because the Gulf of Mexico is not equivalent to the Pacific or Atlantic Coasts.

Another commenter asked why in the Marine and Coastal Birds Section there was no discussion of shorebirds and seabirds for the Alaska Region, while a discussion on Alaskan shorebirds and seabirds was included for the Pacific Region.

b. Issue Was Raised by

U.S. Dept. Of The Interior, Fish And Wildlife Service, Smith; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; State Of California, State Lands Commission, Sanders; Natural Resources Defense Council, Technical Review Panel, Wald.

c. Response to Issue

Although the conclusions for a particular resource may differ among regions, they are not contradictory. The general character of the coastal regions of the United States varies based on many different factors such as climate, oceanographic conditions, types of plants and animals, ecological attributes, and human influences. Although many of the same environmental resources are affected by oil and gas development in the four OCS regions, the analyses and conclusions reached will frequently differ because of these varying factors. The analysts must take into consideration the current condition of the resource or any trends in its condition, the level and type of infrastructure necessary to develop the resources, and influences of climate, currents, and other environmental variables. Based on all the different factors, the analyst makes specific assumptions relevant only to a particular region or resource. The resulting analyses are not inconsistent but reflect these differences in environmental conditions and impact causing factors.

We agree that the general characteristics of each OCS region vary. The analysis of the potential environmental impact of the proposal, taking into consideration the various characteristics of each OCS region, is presented in Section IV.D. The purpose of Sections IV.E, IV.F, and IV.G is not to duplicate the discussion in Section IV.D but to provide a discussion of particular subjects required by NEPA. Section IV.E summarizes the potential unavoidable adverse effects of oil and gas development, while Section IV.F provides an overview of the long-term and short-term effects of the proposal on the affected environment. Section IV.G describes which resources would be irreversibly and irretrievably committed, if the proposal was adopted. These topics are germane within a national context for the overall proposal and are not necessarily exclusive to particular planning areas or regions. However, in each section it is noted where an effect or commitment of a resource was only associated with a particular region.

The format used in the EIS was based on the remand from the United States Court of Appeals for the District of Columbia Circuit on the previous OCS oil and gas program EIS. In response to the Court's holding, the analysis of migratory species, such as marine and coastal birds is organized in a single, coherent section. This results in the placement of the analysis for a species within a section for only one of the regions along the species' migratory route. For example, there is a single analysis in the Pacific Region section for seabirds and shorebirds that occur in the Pacific and Alaska Regions. The analysis, therefore, considers the effects of simultaneous, inter-regional development on the migratory species along its entire migratory route. This approach provides the decision maker and reader with a comprehensive section on the potential impacts associated with the proposed program for that species.

ISSUE 6. Analysis Is Not Specific Enough.

a. Definition of Issue

Comments about the level of detail or the precision of the analysis in the draft EIS were common. Some suggested that the analysis is too "generalized," "broad-based," or "shallow." Other comments argued that the analysis does not exhibit needed "high-resolution" and "quantitative" characters. In addition to generic concerns, comments also indicated the EIS must provide county-, community-, and OCS block-specific analyses. Finally, it was suggested that a separate analysis (and perhaps EIS) should be prepared for each OCS planning area.

The principal concern common to all these comments is that the analysis in the draft EIS does not indicate on a site-specific basis what will occur if leases are sold and developed as part of the proposed program. Further, many of the comments indicated that it would be inappropriate to make decisions about the proposal until such information is developed.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; Coastal Resource Center, California, Laychak; San Luis Obispo County Planning Dept., California, Euphrat; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders; State Of Florida, Dept. Of Environmental Regulation, Latch; State Of Florida, Office Of The Governor, Chiles; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of North Carolina, Dept. Env/Health & Nat. Res, Plan.& Asses, Lewis; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of Broward, Florida, Office Of Planning, Burgess; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Northwest Arctic Borough, Alaska, Greene; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Friends Of The Earth, Nelson; Kodiak Environmental Network, Alaska, Stahl-Johnson; League Of Women Voters, Ventura County, California, Fellows; Natural Resources Defense Council, Technical Review Panel, Wald; Shell Oil Company, Beckmann; McMahon; Anchorage, AK Public Hearing, Testimony; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The level of detail of the analysis presented in this EIS is tailored to the decision it supports. That decision is to adopt a nationwide schedule for considering leasing on the OCS over a 5-year period. It is appropriate that the analysis in the EIS is broad in scope because decisions on the proposed program will be broad in scope. A more specific analysis is not needed.

The decisions that will be made on the proposed program are not decisions to sell leases. Neither are decisions on the proposed program decisions to allow any drilling or production. The NEPA analyses supporting leasing and lease development decisions will be prepared at the time those activities are being considered for approval. Analyses for leasing and lease development will be more site-specific than the analysis in this EIS because the scope of those types of decisions will be more focused. This "tiered" approach to NEPA analysis is provided for in the EIS regulations (see 40 CFR 1502.20 and 1508.28).

ISSUE 7. The Cumulative Impact Analysis Is Incomplete or Inadequate.

a. Definition of Issue

Commenters stated the draft EIS did not fully address the additive or synergistic responses to the exposure of populations to multiple activities and impact producing factors. They suggested that the final EIS should present the analytical approach that was used to evaluate additive and synergistic effects.

Other commenters stated the cumulative analyses should reflect an assessment of the additive impacts of past, present, and reasonably foreseeable future actions or activities.

Additional comments indicated the draft EIS did not evaluate the cumulative effects of multiple oil spills, the chronic release of oil and other toxic substances, and should assume that spills will occur most frequently where activities are most concentrated.

Commenters stated the draft EIS said nothing of the impacts which have already occurred as a result of OCS activities, in particular, indirect effects of these activities which have yet to be fully realized.

Commenters indicated the draft EIS failed to adequately consider the existing or anticipated uses of the sea and seabed including fisheries, shipping, sealanes, military use areas, etc.

Other commenters suggested the EIS should indicate that the proposal will result in a continuation of past development activities, and the impacts arising from these past activities and new impacts will accumulate.

Commenters stated the draft EIS did not quantify the cumulative effects of OCS leasing and did not evaluate the cumulative potential of leasing in areas known to have geohazards. The draft EIS also failed to access meaningful cumulative impacts in many instances (e.g. endangered or threatened species) as it averaged impacts over vast areas such as the entire Pacific Ocean or entire Southern California Bight. Other commenters stated that currently 88 of the 105 active leases in the Southern California Planning Area remain undeveloped and it is unclear whether the regional impacts that will result from their development are considered in the assignment of cumulative impacts.

A commenter inquired what is the relationship of recovery time to cumulative impact.

b. Issue Was Raised by

U.S. Dept. Of The Interior, National Park Service, Galvin; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; Port San Luis Harbor District, California, Moffitt; State Of California, Coastal Commission, Hansch; State Of California, Washington Office Of The Governor, Wilson; State Of Louisiana, Department Of Natural Resources, Swan; State Of Louisiana, Department Of Natural Resources CMD, Howey; State Of Maryland, Department Of The Environment, Scotto; Assoc. Of Monterey Bay Area Governments, California, Nunn; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; County Of Santa Cruz, California, Board Of Supervisors, Keeley; ECO SLO, California, Kupper; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Coalition To Restore Coastal Louisiana, Kemp; Friends Of The Earth, Nelson; League Of Women Voters, Oregon, Eaton/Cottingham; League Of Women Voters, Ventura County, California, Fellows; Natural Resources Defense Council, Technical Review Panel, Wald; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, National Ocs Subcommittee, Taylor; Garbow; Weiss; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

An example of the evaluation of additive and synergistic effects in the draft EIS is the inclusion of the non-OCS-related TAPS operations in the cumulative analyses. Though not currently related to OCS activities, the TAPS pipeline and vessel transportation may be used for future OCS production. The effects of this ongoing vessel traffic, emissions, effluents, risk of collision and oil spills, etc. and the additive effects of similar OCS activities, as discussed in the base case analyses, are factored into the Alaska, Pacific, and Gulf of Mexico regional cumulative resource analyses. The synergistic effects (joint action/increased effects) are factored into the cumulative resource analyses by considering the potential joint action of a vessel collision, a subsequent oil spill, a delayed cleanup effort, combined with inclement weather, and inadequate food availability. The effects would be manifested by increased vessel traffic, effluents, water degradation, emissions, disruption and contamination of existing food sources, noise disturbance, degradation of habitat by oil, detergents, mechanical equipment, etc. This would result in direct and indirect mortality of adults through the joint action of oiling and hypothermia and indirect loss of juveniles/eggs through the joint action of oil contamination of adults, starvation, or abandonment of preferred habitat. The above detail is not included in each cumulative resource analysis because some of this analysis is already in the generic analyses in

Section IV.A and in the base case analyses in Section IV.D.1.a, and it is not repeated in the cumulative Section IV.D.l.c to reduce redundancy and size of the document. Also see Issues 6 and 8.

In regard to the cumulative assessment of the additive impacts of past, present, and reasonably foreseeable future actions or activities, the cumulative analyses in the draft EIS have four basic components: 1) A brief description of the resource to be analyzed (summarized from Chapter III of the EIS). This descriptive information establishes the current status or existing condition of the resource and reflects the effects of past or prior OCS- and non-OCS-related impacts on the resource. 2) A discussion of the specific OCS-related and non-OCS-related activities and impact producing factors (IPF's) that may potentially affect the resource (summarized from Section IV.A). The elements of the cumulative scenario are presented in Section IV.D.1.c, namely: the estimated cumulative resource estimates, exploration and development activity, offshore and onshore infrastructure, and oil spill assumptions and probabilities for each OCS region or subregion. This information is presented in Tables IV.D.1.c-1 through IV.D.1.c-6 and is the basis for the past, present, and reasonably foreseeable future OCS related activities and IPF's for each region or subregion. 3) A description of the effects of the OCS- and non-OCS-related activities and IPF's (both routine and accidental) on the resource; a summary of the analysis with an indication of the expected additive/synergistic/cumulative effects or change to the resource. 4) A statement of the overall cumulative conclusion which incorporates the nature, magnitude, and duration of the effects or change to the resource. The base case analyses are incorporated (not repeated) into the cumulative analyses as OCS-related additive effects of the proposed action.

In regard to the analysis of multiple oil spills, the chronic release of oil and other toxic substances, and their spill or release sites, the assumptions for oil spills are explained in Section IV.D for the base, high, and cumulative scenarios. The locations of the oil spills were selected on the basis of: 1) the major population center or habitat of the resource, 2) the migratory route or biologically sensitive area for the resource, 3) the assumed location of the origin, mode of transportation, and destination of the product, and 4) assuming contact with the resource. The effects of multiple spills are discussed in the analyses in Section IV.D. The assumptions regarding the distribution and occurrence of spills greater than 1,000 bbl are reasonable considering historical oil spill statistics. The effects of toxic substances are considered in Sections IV.A and IV.D in the analyses of drilling and production discharges and emissions.

The impacts which have already occurred as a result of ongoing OCS activities are taken into account in the description of the affected environment (Chapter III). Indirect effects are addressed in the analyses of the base, high, and cumulative cases in Chapter IV. See also Issues 6 and 8.

The existing and future uses of the sea and seabed are considered in Chapter III of the EIS under the appropriate resource headings (e.g. fisheries is discussed under fishery resources, etc.). The analyses of the potential effects on these resources are in Sections IV.A and IV.D.1.a and IV.D.1.c of the EIS. Military use areas are discussed in Section IV.B.1.

The EIS does recognize that any activities resulting from the proposal will be in addition to OCS oil and gas activities begun under prior leasing programs. The cumulative analysis (Section IV.D.c) is based on a scenario that includes activities associated with previous lease sales. Many of the expected impacts in the cumulative case are greater than in the base case analysis, due in part to these ongoing oil and gas activities.

The quantification of cumulative effects are discussed in Issue 4. The cumulative effects of leasing in geohazard areas off California are discussed in Section IV.A and evaluated in Section IV.D.1.c in the Pacific Region subsection.

The analysis of cumulative impacts in southern California (Section IV.D.1.c.) is based on levels of exploration and development assumed to occur on existing but undeveloped leases offshore California. The assumptions used in the cumulative analysis are listed in Tables IV.D.l.c-2 through IV.D.1.c-6. The base and high case analyses only consider impacts associated with sales in the proposed program. The cumulative analysis, however, considers the impacts associated with OCS activities related to prior and future leasing during the forty year period associated with the Proposed Comprehensive Program.

Recovery time is a factor in the cumulative analysis, which involves estimating the potential additive and synergistic effects from past, present, and reasonably foreseeable OCS-related and non-OCS-related activities on various resources on a regional basis (inter-regional for migratory species). Many of the impact conclusions include an estimated time for the resource to recover to its pre-impact condition, given that some activities (OCS and non-OCS) extend 30-to-40 years into the future.

ISSUE 8. EIS Does Not Include All Relevant Available Information.

a. Definition of Issue

Several general comments were made that the EIS failed to incorporate or properly use all the information that is available and relevant to assessing potential impacts. Many more comments were received on the use of information related to particular impact analyses. Some commenters identified specific sources of information perceived to be needed to do the analyses. The source of information cited most often as being essential to assessing potential impacts of the proposed program was the results of investigations of the *Exxon Valdez* oil spill.

b. Issue Was Raised by

U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; North Slope Borough, Alaska, Mayor, Kaleak; Northwest Arctic Borough, Alaska, Greene; Audubon Society, Mobile Bay, Alabama, Jones; Environmental Center, San Luis Obispo County, California, Kupper; Exxon Company, USA, Humble; Friends Of The Earth, Nelson; League Of Women Voters, Oregon, Eaton/Cottingham; Natural Resources Defense Council, Technical Review Panel, Wald; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Shell Oil Company, Beckmann; Sierra Club, Legal Defense Fund, Inc., Briggs; Bash; Bondy; Cicero; Evans; Haggblom; Shepherd; Anchorage, AK Public Hearing, Testimony; Gulf Breeze, FL Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony; Wilmington, NC Public Hearing, Testimony.

c. Response to Issue

Where appropriate, supplemental information identified in comments has been incorporated into the final EIS. In addition, all analyses have been reviewed to verify that the information used for analysis has been properly cited and that the citations are included in Section VI (references) of the EIS.

Comments pertaining to the use of available information that is relevant to a specific analysis are addressed elsewhere in this section of the EIS. Refer to the discussions for specific analyses. Also, see the response for Issue 9 as it relates to the need for developing additional information.

The EIS does include several references to information about the effects of the *Exxon Valdez* oil spill. In particular, refer to the analyses for Alaska Region birds, marine mammals, and archaeological resources. This represents all the relevant information that was available regarding the accident during preparation of the EIS. We recognize that additional, spill-specific information may be forthcoming. However, the information available about the *Exxon Valdez* and other accidental spills was sufficient to support the level of analysis needed to make decisions on the proposed program. Any additional information about the *Exxon Valdez* accident that becomes available later will be considered in the NEPA reviews that are prepared for leasing and lease development decisions made pursuant to the Proposed Comprehensive Program.

ISSUE 9. Not Enough Information Exists to Do an Adequate Analysis.

a. Definition of Issue

Many commenters expressed the opinion that an environmental analysis suitable for supporting decisions on the proposed program cannot be prepared until more information about the effects of OCS development is obtained. Some of the comments identified a need to complete specific types of environmental or socioeconomic studies. Others suggested that it is not possible to develop some of the information perceived to be needed.

Numerous comments indicated that decisions on the proposed program should not be made until all the studies recommended by the National Research Council to support leasing decisions have been completed. The greatest concern expressed in comments was that there is not enough information available to assess potential socioeconomic impacts. Other common concerns included the need for more information on fisheries, air quality, and physical oceanography.

b. Issue Was Raised by

U.S. Dept. Of The Interior, National Park Service, Galvin; State Of California, Coastal Commission, Hansch; State Of California, Washington Office Of The Governor, Wilson; State Of Louisiana, Department Of Natural Resources, Swan; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of North Carolina, Dept. Env/Health & Nat. Res., Plan.& Asses, Pittman; State Of North Carolina, Dept. Env/Health & Nat. Res., Div. Marine Fish., Hogarth; State Of North Carolina, Dept. Env/Health & Nat. Res., Plan.& Asses., Lewis; Assoc. Of Monterey Bay Area Governments, California, Nunn; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; ECO SLO, California, Kupper; North Slope Borough, Alaska, Mayor, Kaleak; Alaska Eskimo Whaling Commission, Rexford; Environmental Defense Center, California, Chytilo; League Of Women Voters, Dare County, North Carolina, Reporter; League Of Women Voters, Oregon, Eaton/Cottingham; League Of Women Voters, Ventura County, California, Fellows; Natural Resources Defense Council, Technical Review Panel, Wald; Oil Reform Alliance, Alaska, Ott; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, National Ocs Subcommittee, Mannchen; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Adams; Shepherd; Anchorage, AK Public Hearing, Testimony; Gulf Breeze, FL Public Hearing, Testimony; Long Branch, NJ Info. Mtg., Testimony; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The amount and detail of information needed for a NEPA analysis depends upon the decision it is intended to support. The analysis in this EIS must support a program-level planning decision for considering future OCS leasing proposals. While the NRC recommended in their 1989 report that additional studies be conducted to support the OCS natural gas and oil program, the NRC did not recommend that the program be delayed until these studies are completed. The NEPA analyses prepared for past OCS program proposals have been reviewed by the courts. In no case did a court find that NEPA was violated because not enough information existed to prepare an adequate analysis. Also, new information about potential OCS-related impacts is added, as it becomes available, to each succeeding NEPA document prepared for a program proposal. Thus, there is clearly enough information upon which to base an analysis supporting decisions on the current proposal.

The question of whether adequate information exists or can be developed to support decisions for leasing or lease development is not at issue here. The NEPA analyses for leasing and lease development will be prepared at the appropriate time. This will coincide with the time these actions are ripe for decision. This “tiered” approach to NEPA compliance and decision making is encouraged by the NEPA regulations (see 40 CFR 1502.20 and 1508.28).

ISSUE 10. Oil and Gas Resource Estimates and Supporting Data Need Clarification.

a. Definition of Issue

One commenter doubted that it was economic to produce resources from the 87 tracts in southern California because oil production at peak year reaches only 38 million barrels. This would be about 104 thousand barrels per day averaging 15 thousand barrels per day per platform. The commenter also suggested that if the resources were economic, then 7 platforms for the 87 tracts would not be enough. One commenter asked what happens to the gas cap after depletion of oil and that development of this cap after depletion should be reflected in the graph (Figure IV.D.1.A-10). One commenter stated that there are two different conditional gas resource estimates for the Mid- and South Atlantic presented in the draft EIS and asked which is accurate.

b. Issue Was Raised by

State Of California, Washington Office Of The Governor, Wilson; State Of Louisiana, Department Of Natural Resources, Swan; State Of Louisiana, Department Of Natural Resources CMD, Howey; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; New Orleans, LA Public Hearing, Testimony.

c. Response to Issue

Unocal's Platform Gina in the Hueneme Field is currently producing about 15 thousand barrels of oil per day. Therefore, development of the 87 tracts with a peak oil production averaging about 15 thousand barrels of oil per day would be economically feasible. It is anticipated that only 7 platforms will be needed because it is likely that only a limited number of the prospects on the 87 tracts will contain economically recoverable resources. The development of a gas cap usually occurs after the depletion of the oil on a reservoir basis. Figure IV.D.1.A-10 is intended to show the combined timetable of exploration and development for the 87 tracts in the proposed 1996 Southern California lease sale which includes the production of many prospects or potential reservoirs in the area. Production of gas caps from individual reservoirs cannot be separated on this graph because the quantity of gas that can be produced from a cap varies with each reservoir and, therefore, can not be estimated for the entire area under consideration for lease. Both conditional gas resource estimates for the Mid- and South Atlantic are correct. The unleased economically recoverable gas estimate for the Mid- and South Atlantic in the sale area for the proposed program as shown in Figure II.A.1-5 is 4.63 trillion cubic feet. Of that amount, it is assumed that 2.24 trillion cubic feet of gas will be leased, discovered, and produced in the two sales scheduled in the Mid- and South Atlantic for the proposed program.

ISSUE 11. The Oil Spill Estimates and Modeling are Deficient.

a. Definition of Issue

Some commenters expressed the concern that the Oil Spill Risk Analysis fails to consider oil spills of less than 1,000 barrels in size. They felt that because the majority of oil spills fall in the less than 1,000-barrel size category, the Oil Spill Risk Analysis should treat them on an individual and on a cumulative basis.

One commenter was concerned that the use of historical spill data from as early as 1964 would not reflect the technological and safety advances incorporated into present and future OCS activities and so would overstate the likelihood of major spills occurring. Another commenter expressed the concern that, given the extremes of climate and geography of the Alaskan Arctic environment which will stress existing technology, actual spill rates in the Arctic would be higher than those estimated in the draft EIS which are based on historical accidents.

Based on a National Academy of Science's 1989 study, one commenter challenges the accuracy of the draft EIS oil spill analysis and labels the lack of physical oceanography data as a "fatal flaw in the entire draft EIS analysis."

A commenter requested that oil spills from tanker accidents be included in addition to platform and pipeline spills in the risk analysis models for the California coast. Another commenter expressed the concern that the overall levels of marine traffic should be addressed in the oil spill analysis as they felt that overall level of traffic would be a determinant factor in the likelihood of collisions occurring.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; Commonwealth Of Virginia, Council On The Environment, Buttleman; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders; State Of California, Washington Office Of The Governor, Wilson; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; State Of South Carolina, Wildl. & Mar. Res. Dept., Mar. Res. Ctr., Burrell; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; City Of Monterey, California, Community Development, Wojtkowski; County Of Monterey, California, Board Of Supervisors, Karas; County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Cruz, California, Board Of Supervisors, Keeley; North Slope Borough, Alaska, Mayor, Kaleak; League Of Women Voters, Oregon, Eaton/Cottingham; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Stevens & 48 Signatories; Anchorage, AK Public Hearing, Testimony; Gulf Breeze, FL Public Hearing, Testimony.

c. Response to Issue

The Oil Spill Risk Analysis (OSRA) model was specifically designed to estimate risks from large spills over the 20- to 30-year lifetimes of Federal offshore leases. Only spills greater than or equal to 1,000 bbl are addressed, because the trajectory analysis is used primarily to estimate contacts over days, not hours. The large spills are those that are not easily contained, are large enough to resist dispersive forces long enough to be tracked on the ocean surface, and have the potential for causing major impacts. Consequently, only those spills that are large enough to travel long distances on the ocean surface and that could persist for several days or longer are appropriate for simulation by this model. The 1,000 bbl cutoff meets these requirements. It also addresses the bulk of the oil spilled due to OCS activities. Spills of 1,000 barrels and greater, although very infrequent, account for the large majority of the oil spilled in OCS activities. During the time period of 1970 to 1989, there were 1,812 oil spills greater than 1 barrel from OCS activities, with a total of 177,045 barrels spilled. Spills of 1,000 barrels and greater accounted for only 1 percent (12) of these spills, but were responsible for 88 percent of the total volume spilled (155,268 barrels) (USDOI, MMS, 1990). Therefore, the OSRA model addresses the preponderance of the volume of oil spilled by OCS activities and specifically the spills that typically generate major impacts.

The exclusion of small spills from the OSRA model does not mean that their risk has been ignored. The estimated mean number of small spills likely to occur as a result of the proposed action was presented for the base case in Table IV.D.1.a-7 of the EIS. Smaller spills, while more numerous, are more easily controlled, usually of limited damage potential, usually disperse within hours, and are not appropriately addressed by a model (such as OSRA) which uses climatological physical inputs and tracks the hypothetical spills for 30 days (or longer).

As to the concerns of applying historical spill occurrence rates to the Alaskan arctic, MMS uses only U.S. OCS oil production and spill data to estimate the platform and pipeline spill rates, i.e. the number of spills estimated to occur as a result of 1 billion barrels of oil being produced or transported. The advantages are that the rates reflect the magnitude of spill occurrence under U.S. regulation and operational controls, and that the individual spill and production records are readily accessible to the

MMS. The spill data are limited to spills of 1,000 barrels or greater in size, which to date have occurred only in the Gulf of Mexico and Southern California where OCS production has historically taken place. The rates should not be adjusted to account for the environmental conditions in the Alaskan arctic because more stringent engineering and procedural regulations would be applied in these more hostile environments which may offset or even reduce the risk of a spill occurring relative to historic OCS experience. Furthermore, it is not clear that the Alaskan arctic is more hostile as compared to hurricane and cyclone risks in the Gulf of Mexico or earthquake risks in California. Similarly, the rates should not be adjusted downward because of recent improvements in safety and technology. The oil spill occurrence rates do not overestimate the risk because they incorporate the results of trend analyses where a trend can be statistically identified.

The MMS uses a worldwide database in its calculation of tanker spills, as there is little experience in transporting OCS-produced oil by tanker (historically more than 95% of OCS oil has been transported by pipeline). However, data from MMS's worldwide tanker spill database indicates that spill rates calculated for the tanker transportation of the oil from Trans Alaskan Pipeline System from the port of Valdez, Alaska by U.S. flagships is very similar to the worldwide tanker spill rate used by MMS.

The National Academy of Science's (NAS's) 1989 Physical Oceanography Report made three major recommendations for improvements of MMS's oil spill risk analyses (OSRA's):

- Incorporate additional field observations in the risk analysis.
- Perform additional validation of the OSRA methods and results.
- Determine risk assessment approach before designing field programs so that field data are applicable to risk analysis.

In response to the NAS's recommendations, MMS has:

- Held three nationwide workshops in conjunction with the scientific community, including the NAS, to redesign MMS's risk assessment approach and implement the approach into future study designs.
- Replaced statistical wind products with observed wind data in the OSRA model.
- Using the workshops' results, implemented a physical oceanography study in the Southern California Bight which includes OSRA model validation and a modest field study near Pt. Arguello and the Santa Barbara Channel.
- Using the workshops' results, planned a major physical oceanography field study for the Southern California Bight to be initiated during Fiscal Year 1992.
- Initiated the largest physical oceanography field program ever undertaken in the Gulf of Mexico.

OSRA analyses are not performed at the programmatic EIS stage. The detailed scenarios and estimates required for the OSRA analysis are developed at the lease sale EIS stage. At the point that a lease sale EIS is to be prepared for the Southern California Planning Area, the above study products will have been received and incorporated into the OSRA model.

The risk of spills of 1,000 barrels or greater from the transportation of OCS oil was included in the draft EIS. The risk of oil spills from tanker transportation of OCS product was incorporated into the draft EIS analysis for all areas where pipelines are not likely to be used. The oil and gas resulting from OCS production in the Southern California Planning Area are assumed, however, to be transported by pipeline. Tanker spills estimated to occur along the west coast as a result of transporting Alaska OCS oil by tanker were analyzed in the draft EIS. The worldwide tanker spill rate is based on observations of historical tanker spills, many of which were caused by collisions with other (non-tanker) vessels, so the influence of overall marine vessel traffic is incorporated into the spill rate.

ISSUE 12. Too Little Detail Provided on Geologically Prospective Areas.

a. Definition of Issue

One commenter stated that the section on geology and hydrocarbon potential for the Pacific Region should include a discussion of the area's hydrocarbon potential as the title suggests.

b. Issue Was Raised by

County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich.

c. Response to Issue

The section on geology and hydrocarbon potential for the Pacific Region has been revised to describe the hydrocarbon potential of the area (see Section III.C.1).

ISSUE 13. Evaluate Additional Alternatives.

a. Definition of Issue

Comments on the draft EIS contained numerous recommendations for expanding the list of alternatives analyzed. Most comments on alternatives addressed the issue of the size and location of possible future lease sales.

Among the comments on alternatives were specific recommendations to temporarily or permanently exclude from leasing entire OCS Regions (i.e., Alaska, Atlantic, Pacific) or planning areas (i.e., North Atlantic, Hope Basin). Conversely, a few comments suggested that alternatives for larger areas (i.e., Mid/South Atlantic, Southern California, Cook Inlet) and more sales (i.e, Central California) be considered.

Suggestions to evaluate additional "buffer" alternatives were also made. Buffers are areas adjacent to the coast that would be excluded from leasing to protect specific environmental resources. Buffers were recommended for all or part of each OCS Region, and sizes ranged from 12 to 100 miles from the coast. Specific recommendations included 12-mile buffers along the range of the southern sea otter (California) and seaward of the Yukon River Delta (Alaska). A 20-mile buffer was offered for Morro Bay, California. Thirty-mile buffers were suggested for areas around the Pribilof Islands and Unimak Pass in Alaska. One comment requested consideration of a 100-mile buffer for the entire OCS, and others asked for 100-mile buffers offshore Virginia and the west coast of Florida.

One suggestion for an alternative was also made regarding the timing of future lease sales in the Pacific Region. This alternative would base the timing of sales offshore southern California on the availability of existing facilities to support lease development.

Some comments were received that do not relate directly to the issue of size, timing, and location of future lease sales. One suggestion was to evaluate an alternative that promotes renewable and non-oil and gas energy and conservation. Another would make the OCS offshore California an ocean sanctuary rather than developing its oil and gas resources.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Smith; Apalachee Regional Planning Council, Florida, Blume; Commonwealth Of Virginia, State Water Control Board, Weeks; North Central Florida, Regional Planning Council, Kiester; Port San Luis Harbor District, California, Moffitt; State Of Alaska, Div. Of Government CoordinaTion, Rusanowski; State Of California, California Legislature, Assembly, O'Connell; State Of California, Department Of Fish And Game, Bontadelli; State Of

California, Washington Office Of The Governor, Wilson; State Of Florida, Office Of The Governor, Chiles; State Of Louisiana, Department Of Natural Resources, Swan; State Of Louisiana, Department Of Natural Resources CMD, Howey; City Of San Buenaventura, California, EIR Committee, Chase; County Of Monterey, California, Planning And Building Inspection Dept., Maki; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Cruz, California, Board Of Supervisors, Keeley; Citizens Assoc. Of Bonita Beach, Florida, Ward; Coalition To Restore Coastal Louisiana, Kemp; Coastal Resource Service Area, Bristol Bay, Flensburg; Friends Of The Earth, Nelson; Friends Of The Earth, Northwest Office, Nelson; Marathon Oil Company, Gulf Coast Explor. Div., Koenig; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, Lone Star Chapter (Coastal Committee), Rudenberg; Sierra Club, National OCS Subcommittee, Taylor; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Haggblom; Anchorage, AK Public Hearing, Testimony; Gulf Breeze, FL Public Hearing, Testimony; Mobile, AL Public Hearing, Testimony; New Orleans, LA Public Hearing, Testimony; Ocean Springs, MS Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony; Wilmington, NC Public Hearing, Testimony.

c. Response to Issue

Each recommendation for evaluating an additional alternative was reviewed to determine the appropriateness of analyzing it in detail in the EIS. Some of the suggested alternatives are not analyzed explicitly in the final EIS because they are wholly or partially redundant with the alternatives already included in the document. Thus, they have been addressed in the EIS. Specific recommendations that fall into this category are exclusions of entire OCS Regions or Planning areas from leasing consideration during the five-year period covered by the proposed program. Other recommended alternatives are not analyzed in detail in the final EIS because no specific rationale was provided with them to establish a case that they are reasonable. Further, no such basis was identified by USDOI during its evaluation. These include: 1) 100-mile buffers for all or parts of the OCS; 2) permanent bans on leasing; 3) adding lease sales in the Pacific and Atlantic Regions; 4) "phasing" the sale of leases offshore California; 5) and creating a California ocean sanctuary.

A number of recommendations for additional alternatives have been analyzed in the EIS. This was accomplished by adding two new alternatives to the final EIS and modifying several of the alternatives already analyzed in the draft EIS. A brief description of the additions and modifications is presented below, and a detailed description is presented in Chapter II of the EIS.

- Alternative III (Slow the Pace of Leasing). Delete approximately 897 additional blocks from the Eastern Gulf of Mexico Planning Area; delete the 22 northernmost blocks in the Mid-Atlantic Planning Area.

- Alternative V (Establish Coastal Buffers). Delete approximately 107 additional blocks from the Gulf of Alaska Planning Area; in the St. George Planning Area, exclude all blocks within 30 miles of the Pribilof Islands; in the Norton Sound Planning Area, exclude all blocks within 12 miles of the Yukon River delta; in the Hope Basin Planning Area, exclude 42 additional nearshore blocks; and in the Southern California Planning Area, exclude all blocks within approximately 12 miles from shore along the range of the southern sea otter and within 20 miles of Morro Bay.

- Alternative VII (Cook Inlet/Shelikof Strait Enlargement). New alternative that considers holding one sale (250 leases maximum) in an area covering 761 OCS blocks.

- Alternative VIII (St. George and Hope Basins). New alternative that considers holding one sale in the Hope Basin and one sale in the St. George Basin. No sales would be held in Navarin Basin, Norton Basin, or St. Matthew-Hall Planning Areas.

ISSUE 14. Method Used to Identify Alternatives Were Questioned.

a. Definition of Issue

A few comments on the draft EIS questioned the methods that were used to develop the alternatives analyzed in the EIS. Some were concerned with the process used to generate the proposal. Others indicated that an explanation of the criteria and methods employed to select alternatives is needed.

b. Issue Was Raised by

Port San Luis Harbor District, California, Moffitt; Assoc. Of Monterey Bay Area Governments, California, Nunn; City Of Laguna Beach, California, Mayor, Fitzpatrick; City Of Monterey, California, Community Development, Wojtkowski; League Of Women Voters, California, Fuller; Long Branch, NJ Info. Mtg., Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The process used to develop the proposal is presented in the Comprehensive Program Decision Documents. In particular, refer to the Executive Summary and the sections pertaining to individual planning area analyses, equitable sharing, and balancing. The process used to develop the alternatives to the proposal complies with the scoping requirements of the CEQ regulations (40 CFR 1501.7 and 1508.25) and is similar to that presented in Sections I.B.2 of the draft EIS which discusses identification of environmental issues. That section and Section I.B.6 have been amended in the final EIS to better characterize how the “scoping” process lead to the development of the alternatives.

ISSUE 15. Analyses of Energy Alternatives and Conservation Are Inadequate.

a. Definition of Issue

A number of commenters stated that the EIS fails to provide a justification for proceeding with the OCS program in the absence of a federal “least cost” national energy policy incorporating conservation, renewable resources and energy efficiency. Some commenters felt that the EIS should stress or even promote alternative energy sources, energy efficiency and conservation rather than basing alternative analysis on “market forces.”

Several stated that the EIS should present specific alternatives that examine, at various production levels, other energy sources and conservation as fulfilling the energy needs served by offshore oil and gas. Mention was also made that the EIS should not treat total replacement of the OCS program by alternative energy sources under the “no sale” alternative.

One commenter stated that the EIS incorrectly assumed that all un-met energy needs would be met by foreign tanker imports of oil. Another commenter said that the EIS made a questionable assumption that the oil from the proposed action will replace an equal amount of imported oil, thus reducing import tanker trips and associated environmental risks. Another commenter wanted inclusion of a more conclusive statement indicating that reduced OCS production means more spilled oil due to increased tanker traffic.

Several commenters felt that the alternative energy and conservation evaluation in the EIS, especially the ICF study (Appendix C), was biased and not objectively presented. Further, they felt that the Appendix C study was unsubstantiated, undocumented, that the conclusions were entirely subjective and that the qualifications of the authors (ICF Resources) needed mention. One commenter indicated that Appendix C made no mention of erosion impacts from OCS activities nor of radioactive drilling wastes.

Several commenters said that the EIS failed to mention CAFE standards. Another stated that the “externality of impacts” should be presented for the energy alternatives and that the appropriate role in the region and type of market for the alternative be clarified. Several commenters asked for further discussion of impacts related to end uses associated with the energy alternatives. Specific reference was made to drawbacks of using residual fuels, diesel fuels, and smaller cars. One commenter suggested that the EIS refer to "conserved" rather than "forgone" resources when discussing the "no action" alternative.

b. Issue Was Raised by

U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; Port San Luis Harbor District, California, Moffitt; State Of California, Washington Office Of The Governor, Wilson; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; City Of Laguna Beach, California, Mayor, Fitzpatrick; City Of Santa Barbara, California, Brown; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Cruz, California, Board Of Supervisors, Keeley; County Of Ventura, California, Resource Management Agency, Berg; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Citizens Assoc. Of Bonita Beach, Florida, Ward; League Of Women Voters, California, Fuller; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Weiss; Anchorage, AK Public Hearing, Testimony; Gulf Breeze, FL Public Hearing, Testimony; Houston, TX Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The Department of Energy, the Federal department responsible for the development of national energy policy, has published its *National Energy Strategy* (NES). The NES does not use the "least-cost planning" approach to develop its policy. (Appendix 6 to the Proposed Final Program SID discusses the shortcomings of the least-cost approach.) The Proposed Final Program is developed within the framework of the NES, and the NES specifically recognizes the importance of OCS oil and natural gas production to the energy future of the U.S. Furthermore, the NES incorporates conservation, renewable resources, and energy efficiency among the many alternatives considered for emphasis by the Federal government. The NES addresses these issues and serves as the Federal policy that provides, along with the OCS Lands Act, the justification for proceeding with the OCS Program.

Having the alternative analyses stress or promote alternative energy sources, energy efficiency and conservation, rather than being based on "market forces," would present a rather inaccurate picture of likely environmental impacts. As stated in Appendix C (Comparative Environmental Analysis of Energy Alternatives to OCS Oil and Gas) "In the event that OCS production is limited, the Administration is not likely to institute any specific measures designated to offset the effects of reduced OCS oil or gas production," and "Consequently the energy alternative substitution effects and related environmental effects are likely to be those that occur due to market forces." Furthermore, the environmental impacts associated with alternative energy sources, energy efficiency and conservation, are considered in some detail in Chapter III (Potential Energy Alternatives to OCS Oil and Gas) of Appendix C.

To have the EIS present specific alternatives examining other energy sources and conservation as fulfilling energy needs served by offshore oil and gas at various production levels is not feasible. This is also the case with the recommendation that the EIS not treat total replacement of the OCS program by alternative energy sources under the "no sale" alternative. There are so many possible combinations of production levels, levels of energy replacement, and types of replacement (oil and gas substitution, fuel substitution, and conservation), that it would not be possible to compare them. Therefore, the EIS focuses on the most likely mix (scenario) of market-driven replacements for energy that could be produced by the proposed program. At the same time the environmental consequences of each of the potential alternatives, including potential Government-imposed measures, is also examined (Section IV.D.2 and Appendix C).

The EIS does not assume that all "un-met energy needs" would be met by foreign tanker imports of oil. Rather, the likely replacement of un-met energy needs is provided in Table IV.D.2-1 of the EIS, which indicates that imported oil would likely replace 86 percent of the OCS oil and 34 percent of the OCS gas ("switch to oil"). While it is true that OCS production may not reduce the overall tendency in the U.S. to import a greater amount of oil in the future, due to increased demand, it is reasonable to assume that oil resulting from the proposed action does replace most (86%) of the oil that would be imported (under no action), thus, reducing tanker imports and associated environmental risks. The increased risk of tanker spills and associated environmental risks, under the no action scenario, is stated in the Executive summary, and Sections II.B and IV.D in the EIS.

As regards the completeness and objectivity of the ICF Resources (Appendix C) study, it is noted in Section IV.D.2 (Alternative II—No Action) that this appendix "is drawn from a broader and more detailed analysis prepared by ICF Resources (1991) which provides economic analyses of the alternatives and environmental impacts for the complete fuel cycle of each alternative." Thus, much of the substantiation and documentation (e.g., references cited) mentioned by the commenters is available in that document. The authors, ICF Resources, were contracted to conduct the subject study using standard MMS contracting procedures which included meeting technical suitability and experience requirements by the contractor and the ability to fulfill the work statement requirements of the study. Erosion impacts are discussed in the analysis of coastal habitats in Chapter IV of the EIS, and the analysis of radioactive wastes has been expanded in the final EIS (see Section IV.D.1.a).

The CAFE (Corporate Average Fuel Economy) standards are considered under the category of conservation (e.g., in Table III-1, Appendix C). It is presumed that the phrase "externality of impacts" means indirect impacts. It was beyond the scope of the alternative energy analysis in the EIS to look at indirect impacts of each energy alternative on each region of the country for each type of market. Additional analysis of the indirect impacts of numerous alternative energy mixes would not provide information useful for comparing or selecting among alternatives to a proposed schedule of OCS natural gas and oil lease sales.

Several commenters requested further discussion in the EIS on end uses associated with energy alternatives, e.g., elaboration on air quality impacts associated with burning residual fuel oil and diesel fuels and safety concerns with smaller cars. A more detailed analysis of end uses associated with energy alternatives is beyond the scope of this EIS (40 CFR 1501.7). The EIS focuses on issues ripe for decision in accordance with CEQ regulations (40 CFR 1502.20). Additional analysis of end uses is more appropriate for subsequent NEPA documents dealing with specific energy proposals. As stated in the Appendix C Introduction and in Section IV.D.2 (Alternative II - No Action), the EIS deals with the production and transportation related environmental impact aspects of the energy alternatives commensurate with the proposed action being examined in the EIS. The ICF Resources (1991) Background Report considers the environmental impacts associated with the entire life cycle, including end uses, of energy alternatives. As to the suggestion that the EIS refer to "conserved" rather than "foregone" resources in discussing the no action alternative, the latter term more accurately reflects the environmental and economic considerations used in the energy alternatives analyses.

ISSUE 16. Develop Additional Mitigating Measures.

a. Definition of Issue

Numerous comments were received on the issue of mitigating potential impacts of the proposed program. The comments range widely in scope. The broadest of these comments suggests that mitigation policies be developed prior to initiating the lease sale process, that mitigating measures be adopted as part of the Proposed Comprehensive Program, and that measures be developed to address all significant impacts associated with the program. Other comments are more precise in terms of the nature of the mitigation perceived to be needed. Included among those comments are requests that MMS adopt the mitigating measures evaluated in the draft EIS, and to develop addi-

Disagree w/ this.

tional measures addressing impacts from specific activities (oil spills, coastal construction) or to specific resources (wetlands, fisheries, and seafloor habitats).

Many suggestions for specific mitigating measures were also made. Most are intended to minimize impacts from accidental oil spills. They include restricting the use of tankers to transport oil, requiring the use of pipelines to transport oil, enhancing the capabilities of existing oil spill response facilities or creating additional facilities, and establishing treatment facilities for oiled wildlife. In addition to oil spill mitigation, proposals for limiting activities near Unimak Pass (Alaska), air quality monitoring, and pre-decision environmental studies were submitted.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Smith; U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; U.S. Dept. Of The Interior, National Park Service, Galvin; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; North Central Florida, Regional Planning Council, Kiester; State Of Alabama, Geological Survey, Mancini; State Of Alabama, Historical Commission, Oaks; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of California, Coastal Commission, Hansch; State Of California, Department of Fish And Game, Bontadelli; State Of California, State Lands Commission, Sanders; State Of Florida, Office Of The Governor, Chiles; State Of Louisiana, Department Of Natural Resources, Swan; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of North Carolina, Dept. Env/Health & Nat. Res., Div. Env. Mgt., Amerson; State Of North Carolina, Dept. Env/Health & Nat. Res., Div. Env. Mgt, Clark; Assoc. Of Monterey Bay Area Governments, California, Nunn; City Of El Segundo, California, Morries; City Of San Buenaventura, California, EIR Committee, Chase; County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; County Of Ventura, California, Resource Management Agency, Berg; North & Northwest Mayor's Conference, Alaska, Foote; Citizens Assoc. Of Bonita Beach, Florida, Ward; Project Reefkeeper, Operations Center, Lamberta/Stone; Sierra Club, Northwest Florida Group, Radford; Haggblom; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The proposal evaluated in the EIS centers on the OCS Lands Act requirement that USDOI establish, as precisely as possible, the size, timing, and location of lease sales that will be proposed during the 5-year period from 1992 to 1997. Decisions that will be made regarding the proposed program are necessarily limited to these factors. Therefore, only mitigating measures related to size, timing, and location are evaluated in the EIS and will be subject to decision. They are presented in the form of alternatives that are intended to mitigate impacts that might occur under the proposal. Other mitigating measures that relate to decisions at later stages in the OCS program, such as lease sale decisions or approval of development and production plans, will be examined in subsequent NEPA analysis. Thus, the EIS meets the requirement to include an analysis of appropriate mitigating measures.

Consideration of mitigating measures that do not relate to lease sale size, timing, and location (e.g., lease stipulations) is limited in the EIS because decisions on such measures would be premature at the program development stage. However, there are certain lease-specific measures that have been adopted so often in the past that it was reasonable to assume, for purposes of assessing expected program impacts, that they will also be adopted in the future (see Appendix E). This EIS accounts for the possibility that these measures may not be adopted in the future by including an analysis of the impacts that might occur if they are not adopted. Other, lease-specific mitigation will be evaluated as part of the lease sale EIS process when decisions on such measures are appropriate.

ISSUE 17. The EIS Should Contain a Worst-Case Analysis.

a. Definition of Issue

A few general comments were received which asserted that the draft EIS is deficient because it does not contain a "worst-case" analysis of potential impacts. A specific comment was also received indicating that reasonable, worst-case estimates must be used for the air quality analyses.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of San Luis Obispo, California, Air Pollution Control District, Carr; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; American Lung Association, Monterey, Santa Cruz, San Luis Obispo, Stecher; League Of Women Voters, California, Fuller; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The requirement that EIS's contain a worst case analysis was rescinded by the Council on Environmental Quality in 1986. This EIS has been prepared in compliance with the rule regarding incomplete and unavailable information which replaced the worst case requirement (see 40 CFR 1502.22). In this case, the question of incomplete and unavailable information is not at issue because sufficient information regarding potential impacts from the proposal is available and included in this EIS (see response for Issue 9).

Although there is no requirement that the EIS contain a "worst case" analysis, Section IV.H of the EIS contains four analyses (one for each OCS Region) that consider the potential effects of major, OCS-related accidents. The scenarios analyzed in this section are considered to be so unlikely that they are not incorporated into the conclusions about impacts that might be expected from implementing the proposed program or alternatives (see Section IV.D). In fact, only one event with a magnitude similar to those described in three of the four scenarios has ever resulted from OCS development, and that occurred more than 20 years ago.

The analyses contained in Section IV.H are included in recognition of the fact that serious accidents can occur, even though the likelihood of their occurrence is considered extremely low. Three scenarios involve very large oil spills and the fourth describes a gas well blowout and fire. Although they are considered to be extreme events, the accidents described are conceivable if leasing and development occurs as hypothesized in the scenario for the proposed action.

ISSUE 18. Geologic Hazards to OCS Operations Are Not Adequately Addressed.

a. Definition of Issue

A commenter was concerned that because Southern California is a seismically active area, an earthquake could cause a platform to fall over.

It was suggested that information in the geology section for the Pacific Region indicate that there was a serious and possibly hazardous lack of seismic data. They recommended that the area be thoroughly studied before any decision on further offshore oil and gas occurs. They also suggested that seismic data contained in the Point Pedernales and San Miguel Project Environmental Impact Reports (EIR's) be incorporated into the section. Also lacking in the geology section was a discussion of the hydrocarbon potential of the area.

A commenter stated that the EIS should consider the increased probability that an oil spill could occur based on the fact that Southern California is a seismically active area.

b. Issue Was Raised by

County Of Brevard, Florida, Board Of County Commissioners, Schmitt; State Of California, Assembly, California Legislature, Speier; City Of Morro Bay, California, Mayor, Sheetz; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The final EIS (Section III.C.1.a) notes that southern California, both onshore and offshore, is considered seismically active. Potential hazards associated with seismic activity include ground shaking, fault rupture, and slope failure. Regional and local geologic conditions and the local geologic structure pattern affect the potential effects of seismic activity. These factors are considered in the design and evaluation of proposed offshore operations. The MMS platform verification requirements (30 CFR 250) consider two levels of earthquake in the design criteria - the lower level (strength level) event has a return period of 200 years and the upper level (rare, intense) event has a return period of 1,000 years. Although the occurrence of either of these events during the lifetime of offshore operations is unlikely, platforms are designed to specifications for withstanding these events.

In general, geologic hazards are naturally occurring features, processes, and conditions that represent only a potential threat to offshore operations; they are neither continuous nor active threats. The presence of a geologically hazardous condition creates engineering constraints to development. In most cases, the influence of geologic hazards can be effectively mitigated through existing or newly developed engineering and design technologies.

Where specific geologic hazards are identified, mitigating measures must be designed on a site-by-site, case-by-case basis. Some geologic hazards can be effectively mitigated by relocation of the proposed operations. If operations can not be effectively mitigated, development would not be permitted. See the EIS discussion of the effects of the physical environment on oil and gas operations (Section IV.C).

Major faults in the Santa Barbara Channel and Santa Maria Basin have been mapped by many investigators. Based on the known locations and lengths of these faults, calculations have been made of the maximum probable earthquake and ground acceleration associated with each fault. Small scale faults are detected by the site-specific survey required for proposed operations. This information is used in site selection and in the design and engineering of offshore structures.

Areas of potential ground failure or shallow gas are identified by a detailed survey at the proposed site. These factors can be effectively mitigated through design and engineering of the facilities and through special drilling procedures.

Although the geologic hazards are discussed in a regional sense in this document, the level of detail is sufficient for the Secretary to make a decision at the programmatic stage. The additional detail requested is most appropriately done at the exploration and development stage when a specific location and type of operation are proposed.

Section III.C.1.a has been expanded to include additional discussions on mass transport, shallow gas, overpressurizing, ground failure, seismicity, a discussion of the Santa Maria Basin geology and geologic hazards, and oil and gas potential.

Earthquake risk is taken into consideration in the accident rates used in the EIS. These rates are based on historic events and reflect the risk of failure of equipment and processes that are not foreseen. Since in each region equipment is designed for maximum effectiveness in its environment (30 CFR 250), accidents may be considered generic in that the limits of specialized equipment and procedures are exceeded in a usually unexpected manner. Even in the seismically active southern

California area, the record does not contain any evidence that major OCS spills have been caused by earthquakes.

ISSUE 19. Reconfigure the Southern California Planning Area.

a. Definition of Issue

A few comments on the draft EIS indicated a need to make changes to the Southern California Planning Area. Most identified a need to split the planning area into two smaller areas (i.e., one south of Point Conception; one north of Point Conception). The stated purpose of the split would be to recognize that the ecological regime north of Point Conception is distinctly different from the regime south of Point Conception. Other comments on boundaries of the Southern California Planning Area suggested that planning areas be reduced in size and made to conform to discrete geologic basins. The stated purpose for the reduction would be to focus the environmental analysis for the Pacific Region.

b. Issue Was Raised by

County Of Santa Cruz, California, Board Of Supervisors, Keeley; Central Cal. Council Of Diving Clubs, Fhipps; Environmental Center, San Luis Obispo County, California, Kupper; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The boundary of the Southern California Planning Area was established during development of the OCS Program for 1987 to 1992. The principal reason for revising the boundary was to create a planning area that contains all the existing OCS development offshore California. The boundary does not inhibit the analysis of the potential environmental impacts of the proposed program as it relates to the Pacific OCS Region. The EIS evaluates possible leasing and development of 87 OCS blocks that, from a national perspective, lie in relatively small and discrete geographic area. That perspective is suitable and appropriate to support program-level decisions, and it would not change regardless of the boundary used to define the planning area. The concentrated review of the environmental characteristics of the Santa Maria basin which was suggested by one commenter will be completed at the time a leasing proposal is considered for the Southern California Planning Area.

Concerns about the size of the Southern California Planning Area have effectively been addressed by the Comprehensive Program proposal for the Pacific Region. Only a very small portion of the planning area (i.e., 87 blocks) is being considered as part of the proposed program. Further, the blocks identified for leasing consideration lie within geologic areas having proven hydrocarbon potential. The analysis included in the EIS for the Pacific Region focuses on leasing and development of a relatively small part of the planning area. Thus, reducing the size of the planning area would not serve to better focus the analysis of potential environmental impacts.

ISSUE 20. Analysis for Coastal Zone Management Programs and Procedures Is Incomplete or Inadequate.

a. Definition of Issue

Numerous comments were received concerning the conformance of the proposed program with State Federally-approved coastal management programs (CMP). Some commenters maintained that area leasing in the Gulf of Mexico was inconsistent with State CMP's. Others stated that the analysis in the draft Environmental Impact Statement failed to adequately quantify impacts and direct effects of the proposed action on the coastal zone.

b. Issue Was Raised by

Assoc. Of Monterey Bay Area Governments, California, Nunn; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Coalition To Restore Coastal Louisiana, Kemp; Friends Of The Earth, Northwest Office, Nelson; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The MMS has considered the various State and local coastal zone management programs in the development of the proposed program as required by the Outer Continental Shelf Lands Act (OCSLA), as amended. Section 18(f)(5) of the OCSLA requires "consideration of the coastal zone management program being developed or administered by an affected coastal State pursuant to section 305 or section 306 of the Coastal Zone Management Act of 1972 (CZMA)."

It is MMS's position that a Federal consistency determination (CD) is not required for the proposed program. The Supreme Court decision of January 11, 1984, *Secretary of the Interior et al.* v. *California et al.* (104 S. Ct. 656), stated that preparation of a 5-year leasing program was not subject to consistency review. Since the 1984 decision of the Supreme Court, Congress has considered all aspects of the application of Federal consistency to the OCS program. Through the reauthorization of the CZMA by the Coastal Zone Act Reauthorization Amendments of 1990, Congress required review of the consistency of lease sales but did not change in any manner the statutory provisions that apply to the development of the comprehensive program.

The CD or analysis of the conformance of an individual lease sale with State(s) CMP will be executed by MMS at the lease sale stage as required by the Coastal Zone Act Reauthorization Amendments of 1990. To conduct any CZMA-related analysis at the proposed program stage is inappropriate since information regarding the lease sale's size, timing, location and mitigation is too general to conduct sufficient analysis. The lease sale CD will analyze the direct and indirect effects on land and water use and natural resources inside and outside of the coastal zone as required by the CZMA, as amended. Through the analysis contained in the CD, MMS will determine whether the lease sale is consistent to the maximum extent practicable with the enforceable policies of an affected State(s) CMP's. The concern that area leasing is inconsistent with Gulf States CMP's has been and will continue to be thoroughly analyzed in Gulf of Mexico lease sale CD's.

In addition, as required by the CZMA, a detailed analysis of coastal impacts (consistency certification) must be prepared by the lessee if OCS exploration and development and production plans are submitted to MMS. As with the Federal CD, these consistency certifications will analyze the proposed activity's direct and indirect effects on land and water use and natural resources inside and outside of the coastal zone as required by the CZMA, as amended. Each affected coastal State will review these certifications for conformance with the enforceable policies of its CMP and will determine whether the activity will be carried out in a manner consistent with its approved management program. The MMS cannot grant any permit for any activity described in detail in the exploration or development and production plan until: (1) the coastal State determines consistency, or (2) consistency is conclusively presumed, or (3) upon appeal, the Secretary of Commerce issues a consistency finding.

The MMS has satisfactorily identified and evaluated impacts and direct effects of the proposed action on the coastal zone as required by the OCSLA and the NEPA. Chapter IV examined a multitude of potential impacts from the proposed program including: air and water quality, marine mammals, fisheries, subsistence, tourism, recreation, and coastal habitats. In fact, many conclusions quantified impacts in terms of areal extent of the impact (e.g. acres of wetlands affects) and numbers of individuals (e.g. marine mammals) affected. However, as previously stated, the EIS analysis is broad in scope since the precise location and level of activities associated with the implementation of the proposed program are uncertain.

In the development of the proposed program, the MMS has adequately considered and quantified impacts and direct effects of the proposed action on the coastal zone as required by the OCSLA and the NEPA. Any CZMA-related analysis will be conducted as statutorily required. In the case of determining the consistency of area leasing with Gulf States CMP, this issue has been and will be fully analyzed in the CD at the individual lease sale stage.

ISSUE 21. The Analysis of Oil Spill Cleanup Capability Was Incomplete or Inadequate.

a. Definition of Issues

One State agency requested that the EIS include an analysis of the state of the art oil spill containment and clean up capabilities.

Several commenters expressed concerns about the availability of response equipment, particularly with regard to tanker spills both in and beyond leased areas of the Pacific and Alaska Regions. One commenter stated that the *Exxon Valdez* spill showed that a spill originating in one portion of the Alaska OCS can have effects over a wide area. Two commenters recommended that there be a formal mutual aid agreement in place among coastal oil spill response cooperatives in California. One commenter recommended that the Marine Spill Response Corporation's (MSRC) resources and capabilities be included in the discussion on the locations of available equipment, and another stated that it is inappropriate to mention Alyeska's equipment for offshore response, since this equipment is for Prince William Sound only.

Some commenters suggested that the National Contingency Plan (NCP) and the Area Contingency Plan's (ACP's) should entail site-specific planning, especially in relation to environmentally sensitive areas, and procedures to provide exposure information and direct assistance to local communities. They also maintained that these plans should clarify who is in charge of an oil spill response (the lessee, MMS, or USCG) particularly in the event that a decision must be made to initiate in situ burning to contain a spill. These commenters generally expressed the view that decisions made by Federal agencies pursuant to the Oil Pollution Act of 1990 (OPA) should not usurp State and local jurisdictions' responsibilities under State and local laws. They expressed concern that the USCG and State agencies might limit local authority to review oil spill contingency plans (OSCP's) and local government's input into decisions on using chemicals or dispersants. One commenter recommended that Appendix D incorporate by reference Occupational Health and Safety Administration (OSHA) regulations concerning oil spill response.

Commenters expressed concerns about the harsh environmental conditions in Cook Inlet, Shelikof Strait, and the Bering Sea with regard to the conduct of oil spill cleanup operations. One commenter suggested that seasonal currents and "other detailed information" be placed in the analysis about oil spill response to address concerns about ice and frozen sea states.

One commenter contended that Cook Inlet has been polluted extensively by oil companies and lower Cook Inlet is not equipped with any spill equipment or personnel to help clean up spills. Another expressed serious doubts about the adequacy of OSCP's for Cook Inlet where rigs are currently operating. (The operations in question are in State waters—currently there are no Federal OCS operations in Cook Inlet.) Although the OSCP's have been approved for that area, this commenter wrote that only local fishermen are competent to contain and pump oil out of Cook Inlet and that none have been trained to operate oil spill equipment.

One commenter said that MMS should reverse its policy of not holding unannounced oil spill drills in the Alaska OCS Region.

One commenter stressed that the shorelines of Katmai National Park and Katmai Preserve preclude the establishment of base camps to clean up spills and that "the best available technologies" are inadequate for complete clean-up and restoration of Alaskan tidal marsh areas.

One commenter asserted that it is impossible to make surprise inspections to drilling rigs located far offshore. Another expressed doubt about the degree to which new requirements would be enforced and also expressed doubt about an assumption expressed elsewhere in the EIS that facilities would be available onshore to receive bilge washings.

One commenter characterized MMS as expressing expectations that the extent and severity of OCS oil spills would be lessened by improved coastal oil spill contingency planning and maintained that this "disguises the serious problem that no standards of performance exist for oil spill equipment" and is overly optimistic in that the equipment is only marginally effective, especially during rough sea conditions in which it may not even be deployable.

Several commenters expressed doubts about the technical capabilities of response equipment to clean up or contain oil spills in the wind and sea conditions prevailing on the OCS throughout the year, particularly in harsh northern environments. One commenter stated that the draft EIS made no commitment to research and development of oil spill cleanup technology nor commitment to environmentally preferred pipeline transportation infrastructure.

Several comments were received about the effectiveness of in situ burning as a means to control oil spills. One commenter maintained that there is no basis for stating in Appendix D that in situ burning results in up to 98 percent efficiency of oil removal, and that this leaves "the decisionmaker, Congress, and the public . . . with the incorrect impression that *in-situ* burning is a reliable method of cleaning up oil spills." One commenter emphasized that in any environment with high winds, such as the Arctic, a large oil spill will spread uncontrollably. Another asserted that there is no proven way to clean oil off pack ice at minus 70 degrees in gale force winds; and until the petroleum industry is able to demonstrate its ability to clean up oil spills in a temperate maritime environment during foul weather in an unscheduled drill, it should not be given the opportunity to test its ability to prevent oil spills in the Arctic.

One commenter expressed concern that spilled oil trapped in ice might pose a hazard to Alaska native travellers and recommended that MMS target research on how trapped oil affects Arctic ice.

One commenter stressed that the EIS does not clearly emphasize (1) that oil spilled from OCS oil and gas production is minimal compared to vastly greater tanker spills from non-OCS production and (2) that it is much more difficult to respond to tanker spills which can spill all their oil over only a few hours and at great distances from immediate assistance.

b. Issues Were Raised By

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of Health & Human Services, Public Health Service, Holt; U.S. Dept. Of The Interior, National Park Service, Galvin; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders; State Of California, Washington Office Of The Governor, Wilson; State Of New York, Department Of Environmental Conservation, Sovas; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; County Of Santa Cruz, California, Board Of Supervisors, Keeley; North & Northwest Mayor's Conference, Alaska, Foote; Port San Luis Harbor District, CA, Board Of Commissioners, Leane; Alaska Eskimo Whaling Commission, Rexford; Bering Straits Native Corporation, Alaska, Martin; League Of Women Voters, Oregon, Eaton/Cottingham; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, National OCS Subcommittee, Taylor; Maxwell; Weiss; Anchorage, AK Public Hearing, Testimony; Gulf Breeze, FL Public Hearing, Testimony.

c. Response to Issue

In response to a State agency's request that an analysis of the state of the art oil spill containment and clean up capabilities be included in the EIS, Appendix D on oil spill response capabilities was written specifically to assess such capabilities.

In response to the expressions of concern about tanker spills along the Pacific Coast, it should be noted that marine vessel traffic traveling along the Central California Coast is directed about 35 miles offshore, and this reduces risks to the coast. Oil spill risk to the Central California coast from OCS operations is low for several reasons. First, there are no OCS operations along the Central California coast to create a spill risk, nor are any such operations expected as a consequence of the proposed lease sale schedule. Oil spill risks from existing and potential OCS operations more than 100 miles to the south are very low. If oil and gas exploration and development activities occur along the Central California coast, the industry must be able to respond to a spill within the 6 to 12 hour guideline established by USCG and MMS. To comply with that guideline, the oil industry would have to establish equipment depots in the area and station response vessels in nearby harbors. Until OCS activity is permitted offshore Central California, there is no incentive for potential OCS lessees to locate cleanup equipment or supplies in the area. In the meantime, however, the three oil spill response cooperatives on the California coast—Clean Bay, Clean Seas, and Clean Coastal Waters—have formally agreed to provide each other response assistance within the boundaries established by State and Federal regulatory authorities. These cooperatives have also been acquiring new equipment to supplement their existing inventories.

Regarding the apparent unavailability of equipment to respond to such spills and the lack of discussion about the Marine Spill Response Corporation's (MSRC) facilities, Appendix D has been revised to include a discussion of MSRC's planned facilities and capabilities. Also, in response to the comment that it is inappropriate to mention Alyeska's equipment for offshore response since this equipment is for Prince William Sound only, the discussion in Appendix D related to Alyeska's equipment has been modified to reflect this comment.

With regard to the concern that a tanker spill originating in one portion of the Alaska OCS can have effects over a wide area, the MMS agrees with this observation. Currently there is no production or tankering of oil from OCS leases offshore Alaska and, except for Cook Inlet and Prince William Sound, the current oil-spill-response infrastructure is not intended to respond to spills from tankers. Before any OCS development activity could be allowed, a Development and Production Plan and an OSCP would be required to be submitted, reviewed, and approved. The Development and Production Plan would have to describe any proposed tanker activity. The MMS anticipates that if tanker activity were proposed in currently undeveloped areas, existing OSCP's and response capabilities would be substantially enhanced and that spill-response cooperatives would be created by the lessees and strategically located to respond to tanker spills. One encouraging development is that pursuant to the OPA, tank vessels now must have OSCP's which include plans for a worst case discharge. The USCG is currently drafting regulations for such OSCP's.

The OPA amends the Federal Water Pollution Control Act (FWPCA) to upgrade requirements for the NCP. The most significant changes are the requirements that the NCP include (1) criteria and procedures for responding to a discharge, or the threat of a discharge, that results in a substantial threat to public health or welfare; and (2) procedures and standards for removing a worst case discharge of oil, and for mitigating and preventing a substantial threat of such a discharge.

Revisions to the NCP required under the OPA and currently directed by USEPA and USCG have not yet been publicized under the Federal rulemaking process, so specific requirements of the NCP as discussed in revised Appendix D are subject to change. Section I.C. of Appendix D concerning the intergovernmental contingency plan network has been rewritten to reflect current USEPA and USCG thinking concerning the new requirements of the OPA and the NCP. Generally, the OPA establishes many new requirements for Area Committees that are to function under the direction of

USCG Federal On-Scene Coordinators (OSC's) in coastal areas. The primary responsibility of each Area Committee is to develop an ACP which is to include, among other requirements, guidelines for decisions on the use of dispersants. Thus, it will be the responsibility of the USCG Federal OSC's and Area Committees to ensure that Federal, State, and local response agencies and actions are fully coordinated. This process is more fully described in revisions to Appendix D.

In response to the comment that it is unclear concerning who is in charge of an oil spill response, it is the lessee, unless the spill (1) constitutes a substantial threat to the public health or welfare, or (2) is a worst case discharge for the facility in question. In the latter two cases, the USCG Federal On-Scene Coordinator (OSC) likely will be responsible for directing all containment and cleanup efforts. Also, for instances in which in situ burning is initiated, such a step would be taken only with the approval of the Federal OSC.

In the absence of new ACP's the USCG still operates under existing Regional Contingency Plans (RCP's) and the NCP, which provide for designation of USCG and other Federal, State, and local government responsibilities during a major spill event. The ACP's will likely be similar to these existing RCP's. Although individual ACP's have not yet been developed, such plans are not necessary to effect oil-spill-response planning and preparedness for OCS activities. The MMS will be publishing new regulations for oil spill prevention and OSCP's in accordance with Executive Order 12777 which implements requirements of the OPA. However, OSCP's for OCS oil and gas exploration and production operations have had a 20-year head start compared to many vessels and onshore facilities which are only now being required to have OSCP's under the OPA.

Moreover, the absence of ACP's does not diminish an OCS lessee's ability or relieve its responsibility to respond to a spill under its own OSCP. The OSCP is submitted with every Exploration Plan and Development and Production Plan and, as was pointed out in Appendix D, is reviewed and commented on by other Federal and State agencies—primarily USCG and State regulatory agencies. The lessee is responsible for implementing it OSCP and responding to a spill. Lessees are required to have the resources necessary to implement a spill response commensurate with their exploration or development activity. If a spill were to occur at an OCS facility, the USCG has a designated Federal OSC responsible for monitoring the lessee's response efforts and, if necessary, assuming Federal control of the response. As indicated in Appendix D, a 1971 Memorandum of Understanding between the Departments of Interior and Transportation established that MMS (the U.S. Geological Survey in 1971) would have responsibility for actions to control the spill source within a 500 meter radius of a platform and USCG would have cleanup responsibility outside that radius.

In response to the comment that OSHA regulatory requirements should have been incorporated into the Appendix D analysis by reference, the NCP under 40 CFR section 300.150 on "Worker Health and Safety" specifically states:

> (e) Requirements, standards, and regulations of the Occupational Safety and Health Act of 1970 (29 U.S.C. 651 et seq.) (OSH Act) and of state laws with plans approved under section 18 of the OSH Act (state OSH laws), not directly referenced in paragraphs (a) through (d) of this section, must be complied with where applicable. . . . All governmental agencies and private employers are directly responsible for the health and safety of their own employees.

Therefore, it has been made abundantly clear in the NCP that lessees and operators are responsible for complying with all OSHA requirements. A reference to section 300.150 of the NCP has been added to the discussion of OSHA requirements in Appendix D.

Regarding concerns about prevailing weather conditions in Lower Cook Inlet, Shelikof Strait, and the Bering Sea, there is no doubt that these areas pose real challenges to spill response because of their extreme tides, currents, and seasonal ice. The MMS conducts detailed trajectory analyses as part of any lease sale EIS to evaluate the potential movement of a major oil spill from the sale area. Also, as indicated in Appendix D, each project-specific OSCP must include trajectory or risk analyses which provide information on the movement of a potential spill from the site of operations. Trajectory information is used in planning response strategies, including the staging of equipment and identifying biological resources and shoreline areas that are at risk from an oil spill, so that appropriate types and amounts of equipment and logistical support can be established.

In response to the suggestion that seasonal currents and "other detailed information" be placed in the 5-year program EIS analysis about oil spill response to address concerns about ice and frozen sea surfaces, such information is more specifically and appropriately addressed in EIS's for individual lease sales and in the trajectory analyses for project-specific OSCP's.

Concerning the comments about oil pollution in Cook Inlet, the adequacy of OSCP's for Cook Inlet, the training of local fishermen for oil spill response in Cook Inlet, and MMS policies concerning unannounced oil spill drills in the Alaska OCS region, each of these issues will be discussed in order below.

It is important to note that current Cook Inlet operations are in State waters. There has not been any exploration activity on Federal leases in the lower Cook Inlet OCS since 1985, and there is no development or production on the OCS in this area. The OSCP's currently in place in Cook Inlet have been prepared for activities on State of Alaska submerged lands.

The MMS agrees that fishermen are a useful resource for spill response. Fisherman can provide important information, knowledge, and experience about local currents and tides, fishing areas, and other local environmental conditions which are important to an oil spill response effort. Such local knowledge and experience is important in both EIS analyses and in individual OSCP development and implementation, and MMS welcomes such input. Project-specific OSCP's typically identify local fishermen as sources of response vessels and personnel in the event of a spill; and cooperation, coordination, and advanced planning between OCS operators and fishing organizations can facilitate an improved response effort.

In response to the comment that MMS should reverse its policy of not holding unannounced oil spill drills in the Alaska OCS Region, current activities are limited to exploratory drilling activities, which generally last for only a few months. (There are currently no production activities on the OCS offshore Alaska.) For exploratory drilling activities, a lessee is required to conduct two types of spill-response drills: (1) one which entails deployment of equipment to ensure that spill-response crews are familiar with, and can operate the equipment, and (2) a tabletop/communications exercise to demonstrate a lessee's ability to coordinate and manage a major spill response. Lessees are also required to conduct additional deployment drills if operations continue into different environmental conditions (open water to solid ice.) Because of the short duration of exploratory drilling activities in most areas offshore Alaska, the training and number of drills that are required, and the disruption of operations that would be necessary to conduct additional drills, MMS believes that unannounced drills are not necessary or appropriate for exploratory activities. Such drills would not substantially improve a lessee's response capabilities. If production operations eventually develop in Alaska OCS waters, MMS would require unannounced drills for these operations.

In response to the concerns that shorelines of Katmai National Park and Katmai Preserve preclude the establishment of base camps to clean up spills, any plans for exploration or development activities that would result from future OCS lease sales in the area would be required to be accompanied by site-specific OSCP's that would undergo thorough review by MMS, USCG, the State of Alaska, and the public. The location of equipment and staging of personnel to respond to a spill would be dependent upon the location and type of activity proposed. For areas in which base camps for oil spill cleanup could not be established, this would require extraordinary OSCP measures that also would be subject to State of Alaska and public review.

In response to the concern that "the best available technologies" are inadequate for complete cleanup and restoration of Alaskan tidal marsh areas, for many tidal marsh areas attempts at cleanup (removal of oil by mechanical means) can do more harm than good. In some instances bioremediation may help nature restore an oiled marsh. The most common response measure for marsh areas is to place protective booms near the entrances of tidal marshes to prevent oil from entering these areas. The MMS believes that the best alternative is to require use of the most reliable technologies to prevent spills in the first place and to require lessees to have adequate spill-response capability to recover as much oil as possible in case the best efforts to prevent a spill fail.

In response to the comment that it is impossible to make surprise inspections to drilling rigs that are far offshore, the comment is false. Helicopters used for inspection are not uniquely marked, and generally an OCS facility would not have more than about 5 minutes warning that a helicopter is approaching. It is not the nature of OCS operations that a significant deficiency can be corrected in only a few minutes.

Concerning expressions of doubt about the degree to which new stronger requirements will be enforced, MMS has a strong history of enforcing its operating regulations, and OCS operators have an excellent history of improving the safety and environmental soundness of offshore operations. Obviously, funding and staffing constraints make it impossible for MMS to constantly monitor the performance of all operators. However, indications are that OCS operators generally make credible efforts to comply with Federal regulations and generally recommended standards of industry practice. Moreover, the OPA has established new and stringent standards of liability for damages caused by oil spills from offshore facilities that will ensure even greater efforts by industry to minimize the potential for oil spills.

As for the expression of concern about the availability of onshore facilities to receive bilge washings, this is a matter of regulatory responsibility of the USCG that would be more appropriately addressed under proposed USCG rulemaking currently underway pursuant to the OPA.

In response to the comments that no standards of performance exist for oil spill equipment and that the equipment is only marginally effective, MMS clearly stated in Appendix D that "No standards exist for the performance of oil spill response equipment." The MMS also clearly stated that capabilities for using open ocean booms to contain oil are not well documented in waves over 2 to 3 feet, although at least one manufacturer claims to have a boom that has been effectively tested in seas ranging to nearly 10 feet. In Appendix D MMS indicated similar capability limitations for skimmers and stated, "In general, maximum wind speeds of 15-20 knots pose the upper limit for dynamic upwind recovery, and effective recovery in sea states of over 3-4 feet is essentially undocumented." Thus, MMS clearly indicated that the effectiveness of oil spill cleanup and containment equipment is sharply limited by sea states and weather that may prevail over large areas of the OCS during extended periods of the year. One of MMS's objectives in reopening the Oil and Hazardous Material Simulated Environmental Test Tank (OHMSETT) facility at Leonardo, New Jersey, is to develop standard test procedures for the testing of containment booms and skimmers. Standard test procedures are necessary to generate a comparative performance data base. The MMS is completing a test protocol to be used at OHMSETT when it becomes fully operational in 1992.

In response to the comment that the draft EIS made no commitment to research and development of oil spill cleanup technology nor commitment to environmentally preferred pipeline transportation infrastructure, for many years the MMS has had a strong commitment to development of oil spill cleanup technology and transportation of OCS production by pipelines. Transportation of production to shore by pipeline has usually been the subject of lease stipulations adopted for individual lease sales. Over 95 percent of all OCS production has been transported to shore by pipeline. Commitments to research, however, require the expenditure of funds that can only be provided under the Federal budget process. This process is further subject to congressional appropriations (Federal spending laws) which generally approve funding only on a year-by-year basis. During the budget process for Fiscal Year (FY) 1992, the MMS Technology Assessment and Research (TA&R) Program requested $3.2 million increase for oil spill response and pipeline leak detection above the FY 1991 $2.1 million budget for all TA&R projects. Congress approved a $2.1 million increase for oil spill response research in FY 1992.

Concerning the comment that there is no basis for stating that in situ burning results in up to 98 percent efficiency of oil removal, the commenter is mistaken. The basis for the in situ burn removal efficiency of 98 percent is the research that was cited in the first source listed in the bibliography for Appendix D. (Allen, Allan A. 1990. Contained controlled burning of spilled oil during the *Exxon Valdez* spill. Proceedings of the thirteenth Arctic and marine oil spill program technical seminar. Edmonton, Alberta Canada. pp. 305-313.) This source also indicated that in situ burning also has been demonstrated to be a very useful response tool in open-water conditions when used in conjunction with a fire resistant boom.

With respect to comments about the effectiveness of in situ burning as a means to control oil spills, MMS maintains that joint MMS/Environment Canada research since 1983 has increasingly showed that in situ burning has removed various oils with 50-90 percent removal ratios, provide emulsification has not occurred. Numerous laboratory studies, field experiments and demonstrations have shown that very high removal efficiencies can be obtained from in situ burning provided that the oil is contained within a boom or an ice field. These results strongly support the notion that in situ burning may offer the best potential for combating major oil spills that occur during broken-ice conditions and for oil trapped under and within the ice.

As is the case for any spill-response technique, in situ burning will not work in every circumstance. The primary limitations include highly emulsified oil, uncontained slicks, and initial ignition in strong winds. Thus, gale force winds at minus 70 degrees would indeed provide a tough test for in situ burn techniques. The MMS agrees that in any environment with high winds, a large oil spill could spread uncontrollably. In ice or broken ice conditions, however, ice would serve to contain the spread of any spill.

As indicated above, MMS recognizes that there are limits to response technology in milder climates, as well as in the Arctic. Each planning area has environmental conditions which must be considered in oil-spill-response planning and which present both advantages and disadvantages for spill response capability. High wind conditions, while impeding response actions, have sometimes served to disperse spills seaward in a relatively short time, resulting in little apparent impact to shorelines, beaches, and environmentally sensitive areas. (This is not to imply that such conditions or results should be counted on in a spill situation.)

Although the amount of oil recovered from offshore spills is generally less than 20 percent, a significant portion of the spill evaporates or is dispersed or dissolved in the ocean. These recovery factors are derived predominantly from vessel-related spills and not spills resulting from OCS oil and gas activities. Except under ice and broken ice conditions, MMS does not expect a substantial difference in response capabilities between the Arctic and more temperate climates for similar spill events.

However, MMS does believe that there is a substantial difference in response capabilities for OCS oil and gas operations compared to vessel operations. Two of the key factors in determining the success or failure of spill response is preparedness and response time. Offshore spill response is generally successful when response crews and equipment are adequately prepared and immediately available to respond to a spill. Most offshore spills are not related to OCS drilling and production activities, and are generally merchant marine spills or transportation-related spills which have not had a dedicated spill-response capability. (The OPA has new requirements designed to rectify this situation over the next few years.) Such spills often occur in remote locations, and are usually the result of a grounding or a collision at sea under adverse weather conditions.

Unlike vessel-related spills, OCS drilling and production operations have been required for years to have an approved OSCP which includes dedicated crews and equipment which are available and committed to respond to a spill from those operations. In addition, OCS platforms and drilling activities are at known and fixed locations, and this enhances response planning and overall response preparedness. In many instances, spill-response equipment and personnel are located nearby the drilling unit or on the platform itself. Operators are also required to conduct spill-response drills to demonstrate their preparedness for implementing their spill-response plan. For these reasons, pre-established response capabilities and preparedness provide an improved level of response capability over what has been experience with oil spills from vessels not related to OCS production activities.

With respect to concerns about whether spilled oil trapped in ice might cause the ice to become less stable and a danger to travelers, MMS agrees that oil under ice does change the thermodynamic conditions which will lead to quicker melting and deterioration of oiled ice compared to non-oiled ice. Such deterioration would exhibit similar signs as other unstable or weak ice, including slush, cracking and brine channel evolution, which hunters or a person traveling over ice would likely be familiar with. Moreover, visual evidence of oil will increase as it migrates to the top of ice during spring thaw and during ice breakup. In the event of a major spill, response efforts, including public notification and coordination with local communities, marking and tracking the spill movement (including oil under ice) and ongoing cleanup activities should reduce or minimize the potential for hunters or other incidental personnel from approaching or encountering an oil-spill area where the ice may be weakened and dangerous.

In response to the comment that the EIS does not clearly emphasize that oil spilled from OCS oil and gas production is minimal compared to vastly greater tanker spills from non-OCS production, discussion has been added to the introduction to Appendix D explaining the relative differences in risk between non-OCS tanker spills and spills from OCS oil and gas production.

ISSUE 22. Impacts on Water Quality.

a. Definition of Issue

Several commenters stated that more information is needed to support the EIS contention that there appears to be no human health or environmental contamination problems from the discharge of formation water containing naturally occurring radioactive materials (NORM). It was also felt that additional information needs to be presented regarding disposal of OCS generated solid waste onshore. Also, whereas the EIS says that reinjection of produced water is not always technically feasible, it was noted that the EPA believes this is generally feasible in almost all offshore areas. One commenter felt that there was substantial discrepancy in the reported volume of produced water which is produced in the Gulf of Mexico Region (Table IV.A-1) relative to a previous MMS study.

One commenter said that the EIS overstated the effect on phytoplankton attributed to discharges of mud and resuspended sediment. Some commenters felt that more information and/or more detailed treatment was needed to adequately address water quality impacts in the Alaska and California offshore areas. More specific information deficiencies identified included: lack of consideration of environmental impacts of oil spills from placement of pipelines in deep water; no identification as to where and when barging of muds and cuttings for offshore disposal would occur; no treatment of the Santa Maria Basin; and lack of incorporating the results from the 1988 drilling mud symposium in Calgary, Alberta.

One commenter stated that it was difficult to determine actual sensitivity of corals to drilling muds because studies were conducted under unrealistic conditions. With regard to the Gulf of Mexico, one commenter felt that it was misleading to state that "Chronic low level pollution related to the proposal will occur throughout the 45-year life of the proposal."

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; State Of California, State Lands Commission, Sanders; State Of Florida, Dept. Of Environmental Regulation, Latch; State Of Florida, Office Of The Governor, Chiles; State Of Maryland, Department Of The Environment, Scotto; State Of North Carolina, Department Of Administration, OCS Office, Moffitt;

State Of North Carolina, Dept. Env/Health & Nat. Res., Div. Env. Mgt., Ausley; State Of North Carolina, Dept. Env/Health & Nat. Res., Div. Env. Mgt, Clark; State Of North Carolina, Dept. Env/Health & Nat. Res., Plan.& Asses., Flournoy; State Of South Carolina, Wildl. & Mar. Res. Dept., Mar. Res. Ctr., Burrell; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Central Cal. Council Of Diving Clubs, Fhipps; Environmental Center, San Luis Obispo County, California, Kupper; League Of Women Voters, Dare County, North Carolina, Reporter; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Shell Oil Company, Beckmann; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Crane; Gulf Breeze, FL Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The several comments questioning the apparent lack of concern and information regarding naturally occurring radioactive materials (NORM) from formation water represent a misreading of the information in the draft EIS section dealing with "Offshore" discharge of "Formation Water" (Section IV.A.1.b(1)(a). The statement in that section read "Despite these higher levels (of NORM) in formation water as compared to open seawater, there seems to be no apparent human health or environmental contamination problem because of the rapid dilution of these formation waters when discharged offshore." This is based on the work of Reid (1980) and others who suggested that because of the rapid dilution and dispersion effects in a dynamic marine environment, any contamination problems would be limited to an area in proximity (several meters) from the discharge point. The concern with formation water discharges in shallow, less dynamic, nearshore situations was addressed in the draft EIS and is now further elaborated in Section IV.A.1.b of the final EIS.

Because of the possible contamination problem with heavy metals, organics, and petroleum hydrocarbons, and NORM, the State of Louisiana approved (March 1991) regulations banning the discharge of all oil and gas derived wastewaters (primarily produced water) in State waters (see Section IV.D.1.a(1) on Impacts on Water Quality in the Gulf of Mexico Region). Also, the Federal government (USEPA) and the oil and gas industry have embarked on initiatives to study NORM's fate and effect and to examine the feasibility of various disposal techniques. Industry has begun to examine reinjection methods for disposing of not only production solids, but also tubulars and equipment as well. Additional information regarding NORM and onshore disposal of produced water and solid waste has been added to the final EIS (Section IV.A.1.b).

It is not clear from the comments whether the commenters were also referring to human health aspects beyond that related to the offshore discharge of produced waters with elevated levels of NORM. If this is the case, the following is noted. Workers are protected by Federal regulations and statutes which set exposure limits for individuals handling radioactive wastes and substances, and require those handling wastes of this nature to have limited contact with such wastes — requiring the wearing of special apparel, use of particle masks, and breathing apparatus in some cases. Because of the automatic separation/treatment process utilized by industry to separate product from other production fluids, human contact with and exposure to these waters is minimal.

With regard to the concern for inclusion of information on the disposal of OCS generated solid waste onshore, this has been done in the final EIS in Section IV.A.1.b(1)(b). Regarding the discrepancy in reported volume of produced water for the Gulf of Mexico, a modification has been made in the final EIS. Newer and more focused information indicates that approximately 2.4 barrels of produced water (rather than 8.42; Table IV.A-1) are generated for every barrel of oil produced. Table IV.a-1 has been modified accordingly.

The statement in the EIS that reinjection of produced water is an "expensive option and not always technically possible" is not inconsistent with the recent information available, including that presented by the EPA. The topics of cost and technical feasibility are considered in the recent literature, e.g., from MMS (*Estimating the Environmental Costs of OCS Oil and Gas Development and Marine Oil Spills: A General Purpose Model, by A.T. Kearney, June, 1991)* and from the USEPA

(*Regulatory Impact Analysis of the Effluent Guidelines Regulation for the Offshore Subcategory of the Oil and Gas Extraction Industry*, by the Office of Water Regulations and Standards, February, 1991). The EIS does not specifically discuss the factors related to the technical feasibility or infeasibility of produced water reinjection. However, the USEPA (1991) reference above (p.27) states that "there are questions concerning the applicability of reinjection to all structures" and "Although reinjection may be technically feasible in general, depending on geological condition, specific structures would not be able to reinject."

The statement by one commenter that the EIS overstates the effect of discharged muds and resuspended sediments appears to be a misinterpretation of the discussion presented in Section IV.A.1.a(2)(a) on "Impacts Associated with Physical Emplacement of Equipment or Facilities" on affected "Lower Trophic Organisms." That section of the EIS simply states the possibility of a temporary affect on plankton, without an accompanying discussion of severity or significance. The commenter is directed to Section IV.A.b(1)(a) on "Impacts Associated with Discharges and Emissions" as affecting "Plankton" where the effects of mud plumes are more extensively discussed and a conclusion is made that "the general populations of plankton over the large area (miles), with their short generation times (hours/days), would remain unaffected."

Concerning the comments that more information and more detailed treatment was needed in the EIS to adequately address water quality impacts in the Alaska and California offshore areas, it is felt that the extent and level of treatment given in the EIS on this topic is generally appropriate for a programmatic EIS and conforms with the CEQ requirement that the more significant environmental problems should receive greater emphasis in the EIS (40 CFR 1502.2(c)). In some areas of concern, however, additional information, as requested by the commenters, was provided. For example, additional information is provided regarding water quality in Santa Maria Basin off California (Section III.A.1.c).

Regarding the request for further discussion on (a) oil spills resulting from placement of oil pipelines in deep water in proximity to coral reefs and low relief banks including consideration of rerouting and mitigating measures, and (b) when, where and under what circumstances would barging and onshore disposal of drill muds and cuttings would occur, these are site-specific concerns that can only be adequately addressed at the lease sale stage. As to the comment that the EIS lacks mention of the 1988 drilling symposium in Calgary, it is noted that MMS was a sponsor and participant at the symposium and that the proceedings (*Drilling Wastes*, 1989) were reviewed but provided limited useful information to the preparation of the EIS.

It may well be that some of the studies on the effects of drilling muds on corals, as summarized in Section IV.A.1.b(1)(b), were conducted under "unrealistic" exposure conditions. Nevertheless, the results of all these studies still leave reason to believe that coral reefs may be particularly sensitive to effects of drilling muds, as concluded in the EIS.

We do not believe that the conclusion in the EIS with regard to effects of OCS activities on water quality in the Gulf of Mexico (Section IV.D.1.a(1)) is incorrect or misleading. Admittedly, the effects of OCS drilling and operational discharges (e.g., muds, cuttings, produced waters) on water quality are generally expected to be limited to an area around the rigs (e.g., the mixing zone). Nevertheless, this still constitutes a "Chronic, low level pollution . . . throughout the 45-year life of the proposal" because discharges from activities associated with the proposal will be ongoing throughout this period.

ISSUE 23. Impacts on Air Quality.

a. Definition of Issue

Many commenters stated that the air quality impacts associated with the proposed program were not adequately described. Some of the commenters suggested that more quantitative information was needed on projected air emissions and impacts, or that the information presented was incomplete.

Several commenters were of the opinion that emissions and impacts were underestimated, while one commenter suggested that projected emissions were overestimated. Some commenters stated that impacts from OCS- related onshore facilities such as processing facilities and refineries were not adequately described.

Several commenters were of the opinion that the analysis was not based on reasonable worst-case assumptions. One commenter stated that the modeling analysis was inadequate, particularly for ozone.

Several commenters stated that the relevant local regulatory requirements were not presented in sufficient detail. In particular, the opinion was expressed that for the nonattainment areas affected, the analysis should have included a discussion of how emission offsets would be obtained, an identification of specific categories of offsets, and a description of the impacts of these offsets on existing and future onshore industries. Some commenters expressed concern that development on the OCS would adversely affect existing onshore industries and would inhibit future growth because the amount of offsets available for onshore industries would be further limited.

One commenter noted that the impacts discussion failed to mention some of the positive changes from recent advances made in solving some of the regulatory issues as a result of the California OCS negotiated rulemaking. Another commenter noted the air quality benefits of natural gas consumption as compared with other types of fossil fuels.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; Exxon Company, USA, Tibbitts; League Of Women Voters, San Luis Obispo, California, Hund; Port San Luis Harbor District, California, Moffitt; State Of California, Air Resources Board, Sharpless; State Of California, Coastal Commission, Hansch; State Of California, South Coast Air Quality Mgmt. District, Greenwald; State Of California, State Lands Commission, Sanders; State Of California, Washington Office Of The Governor, Wilson; State Of Florida, Office Of The Governor, Chiles; State Of Maryland, Department Of The Environment, Scotto; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of North Carolina, Dept. Env/Health & Nat. Res., Div. Env. Mgt., Amerson; City Of El Segundo, California, Morries; City Of Laguna Beach, California, Mayor, Fitzpatrick; City Of Morro Bay, California, Mayor, Sheetz; City Of Santa Barbara, California, Brown; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Air Pollution Control District, Carr; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; North Slope Borough, Alaska, Mayor, Kaleak; American Lung Association, Monterey, Santa Cruz, San Luis Obispo, Stecher; Environmental Defense Center, California, Chytilo; League Of Women Voters, California, Fuller; League Of Women Voters, Dare County, North Carolina, Reporter; Sierra Club, National OCS Subcommittee, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Unocal 76, North American Oil & Gas Division, Attebery; Weiss; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

Air emissions and impacts were estimated by making assumptions about the number of platforms, wells, vessel trips and other activities that would hypothetically be associated with the estimated oil and gas resource. The size and location of individual facilities resulting from the Proposed Program cannot, of course, be predicted in this program phase. The results of the analysis presented here should, therefore, be viewed as representing the regional-scale impacts. It is not possible to determine impacts for a specific location or community with the scenario developed for a program proposal.

Emissions from a hypothetical onshore processing facility are presented in Section IV.A.1.a.(1)(b). Emissions will vary considerably depending upon the various properties of the oil such as density and sulfur content as well as plant design considerations. Emissions from refineries were not considered in the analysis since these facilities process crude oil from many sources other than the OCS.

Air quality impacts discussed in this document were estimated by examining results of modeling calculations performed for recent, proposed lease sales. Modeling of emission sources associated with development in the various OCS planning areas has generally shown that concentrations of nitrogen dioxide, sulfur dioxide, carbon monoxide, and particulate matter are below the levels considered to be significant. If this Proposed Program is adopted, a modeling analysis will be performed specific to each planned lease sale. At that time a better estimate of the production and the geographical distribution will be available. Once a lease is issued, a detailed environmental analysis is performed for each exploration and development/production plan.

No modeling of photochemical pollutants from activities in the Gulf of Mexico Region has been performed to date. However, MMS is presently cooperating with USEPA in using the Regional Oxidant Model (ROM) to estimate contributions to ozone levels from OCS sources in the Gulf of Mexico. The MMS will also start in 1992 a three-year monitoring and modeling study to determine effects of emission sources on the Gulf of Mexico OCS on ozone nonattainment areas in coastal Texas and Louisiana.

As stated in Section IV.A.1.a.(1)(b), air quality on the OCS, except for the Western and Central Gulf of Mexico, will be under the jurisdiction of the USEPA. For any facilities located within 25 miles of a state's seaward boundary, regulations would be the same as would be applicable if the source were located in the corresponding onshore area, including State and local requirements for emission controls, emission limitations, offsets, permitting, monitoring, testing, and reporting. Enforcement of these regulations may be delegated to the States.

The use of offsets in a permit program would be carried out according to the USEPA's Emission Trading Policy, which requires that emission reductions from existing sources that serve as offsets must be real, quantifiable, surplus, and enforceable. Since any potential development resulting from the proposed program would span about a 30-year period, it is not possible to identify specific categories of offsets. It would be the responsibility of the applicant to find offsets, and enter into an agreement with the responsible agency to incorporate the offset into the permit provisions. It also is not possible to predict how the future demands for offsets would affect offshore as well as onshore industries. In California, offsets could soon become quite scarce as a result of stringent, new regulatory requirements for ozone nonattainment areas. On the other hand, new technologies may be developed that could ease some of the scarcity of emission offsets in the future.

It is acknowledged that the California OCS rulemaking has resulted in a greater understanding among regulatory agencies and industry of some of the technical and regulatory issues. Moreover, it has resulted in an exchange of technical information that led to the compilation of a list of potential control measures specifically applicable to offshore emissions. Some of these control measures have already been incorporated in recently installed or planned facilities on the California OCS. These technologies have been accounted for in the discussion of impacts for the Southern California Planning Area presented in Section IV.D.1.a.(2)(c). We acknowledge that there are certain benefits associated with the use of natural gas as an energy source as opposed to other types of fossil fuels. However, since the purpose of the EIS is to present impacts associated with the development of oil and gas resources rather than the consumption of the products, the relative benefits of gas consumption could not be discussed here.

ISSUE 24. Impacts on Global Climate Change.

a. Definition of Issue

One commenter stated that the discussion of the incremental contribution to greenhouse gases from OCS activities was insufficient in that it ignored cumulative effects from all other sources, most of which by themselves are also relatively small compared to the total contribution. The commenter encouraged adoption of a strategy that would minimize contributions to greenhouse gases as well as consideration of conservation and alternative energy sources.

b. Issue Was Raised by

U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; State Of California, State Lands Commission, Sanders; Weiss; Anchorage, AK Public Hearing, Testimony.

c. Response to Issue

We recognize that the cumulative effect of all other sources of greenhouse gases may be significant in potential global climate change. However, we assume that there will still be a need for continued development of oil and gas resources in the foreseeable future, even though alternative energy sources will likely be developed as well as technology that results in greater energy efficiency. Emissions of greenhouse gases would result whether oil is developed offshore the U.S. or oil is imported from abroad. A comparison of environmental impacts resulting from various alternative energy sources is presented in Appendix C. It should also be noted that for all OCS areas other than those off Alaska, natural gas is expected to represent a large majority of the total energy resources that would be developed under the proposed program. The use of natural gas results in significantly lower emissions of CO_2 than the use of either coal or oil.

ISSUE 25. Impacts on Marine Habitats

a. Definition of Issue

Several commenters suggested that the potential impacts of the activities described in the proposed program on benthic habitats, such as pinnacle trends, hard/live bottoms, submerged aquatic vegetation (SAV) beds, intertidal areas, and chemosynthetic communities, were understated or not adequately addressed. In addition, some commenters requested addition of specific benthic habitats, such as Gulf of Mexico deep SAV beds, Florida Keys National Marine Sanctuary, the upwelling area at Santa Lucia Bank, Kelp forest ecosystems, and intertidal areas.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; State Of Alabama, Geological Survey, Mancini; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of California, State Lands Commission, Sanders; State Of Connecticut, Dept. Of Environmental Protection, Rocque; State Of Florida, Office Of The Governor, Chiles; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; State Of South Carolina, Wildl. & Mar. Res. Dept., Mar. Res. Ctr., Burrell; State Of Washington, Office Of The Governor, Booth; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; Assoc. Of Monterey Bay Area Governments, California, Nunn; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; ECO SLO, California, Kupper; Audubon Society, Mobile Bay, Alabama, Jones; League Of Women Voters, California, Fuller; Project Reefkeeper, Operations Center, Lamberta/Stone; Shell Oil Company, Beckmann; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Perrin; Stevens &

48 Signatories; Gulf Breeze, FL Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

Every effort has been made to provide a realistic analysis of the proposed program and the estimated potential impacts that may result from the proposed program. These analyses are based upon the best scientific information that is available from the resource agencies responsible for obtaining information on the marine and coastal environment, academia, the general scientific community, and research funded by MMS. As additional information becomes available, it will be incorporated into future, lease-offering specific, EIS's.

The level and scope of analysis provided is appropriate for a planning document, such as the programmatic EIS. More detailed and specific analyses will be provided in lease-offering EIS's, which also undergo full public participation and review as required under NEPA. In addition to narrowing the scope of analysis, lease-offering EIS's allow the analysts to provide more detailed discussion of particular habitats or organisms. It is at this stage in the comprehensive Program that more specific information on the timing, geographic area, potential resources, and estimated impacts become available for a more focused NEPA analysis. This approach is consistent with the tiering procedures of the CEQ regulations (see 40 CFR 1508.28).

Where additional or restructured information can help clarify the EIS analytical process, such as estimating oil spill effects on benthic habitats in the Atlantic or describing the mud/sand benthic community of the Gulf of Mexico, the EIS has been modified to address the concerns of the commenters. In some cases, information on specific habitats was contained in other sections of the EIS (such as discussions of SAV in the Atlantic Region which can be found in the Coastal Habitats section (see Section IV.D.1.a(8)).

ISSUE 26. Impacts on Coastal Habitats

a. Definition of Issue

Many commenters were concerned about the lack of specific information pertaining to particular areas along the U.S. coasts, such as Morro Bay and Nipomo Dunes in California and the Apalachicola River, and the potential effects of the proposed program on these habitats. Additional concerns were voiced that any impacts on west coast wetlands were unacceptable, because of the limited availability of these habitats. Requests for more focused analysis of specific coastal habitats in other geographic areas were also submitted.

A number of concerns were also raised about the assumptions used to analyze the potential effects of the proposed program on wetlands in the Gulf of Mexico and discrepancies between EIS's for previous lease offerings, the draft EIS for the proposed program, and the information in the Secretarial Issue Document. Some commenters disagreed with the assumption that wetlands loss due to erosion from vessels associated with OCS activities would remain nearly the same in the base and high case.

A common concern was the analysis of potential impacts to wetland and estuarine habitats in all four OCS regions. Most commenters indicated that they thought the potential impacts were not adequately addressed and that the potential effects were underestimated. Also, it was suggested that the analysis should take a more holistic approach to the ecosystem rather than addressing each coastal habitat individually.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; U.S. Dept. Of The Interior, National Park Service, Galvin; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders;

State Of Louisiana, Department Of Natural Resources, Swan; State Of Louisiana, Department Of Natural Resources Cmd, Howey; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of South Carolina, Wildl. & Mar. Res. Dept., Mar. Res. Ctr., Burrell; State Of Washington, Office Of The Governor, Booth; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Cruz, California, Board Of Supervisors, Keeley; ECO SLO, California, Kupper; Port San Luis Harbor District, Ca, Board Of Commissioners, Leane; Environmental Center, San Luis Obispo County, California, Kupper; Greenpeace, Washington, D.C., Alexander; League Of Women Voters, California, Fuller; Sierra Club, National OCS Subcommittee, Taylor; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Blanke; Bondy; Evans; Martin; E. Nelson; K. Nelson; Perrin; Samuelson; Stevens & 48 Signatories; Anchorage, AK Public Hearing, Testimony; Gulf Breeze, FL Public Hearing, Testimony; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The EIS for the proposed program is, of necessity, a planning document that—within the constraints of the resource estimates and assumptions—attempts to provide a meaningful analysis of the anticipated environmental effects that may result from the program. As such, it is not necessary, nor desirable, for the proposed program EIS to be encyclopedic in listing all specific habitats of the U.S. coasts (40 CFR 1500.4(b)). However, the EIS does address those habitats that are likely to be affected by the proposed program and are incorporated into the determination of the overall potential effects that may result from the proposed program. Therefore, some of the specific areas mentioned by the commenters—such as the Apalachicola River—were not included because they did not lend additional significant information for the analysis. However, additional information on other areas specified by various commenters—such as the Bay National Estuarine research Reserve, Morro Bay, and Nipomo Dunes—has been added to the EIS to clarify the logical progression of the analysis (see Chapter III).

It should be noted that for those proposed offshore areas selected for inclusion in the 1992-1997 Program, a more detailed analysis of the specific lease offering will be performed based upon the better defined information that will be available at that time.

The apparent discrepancy in wetland losses between previous EIS's and the programmatic EIS is due to a typographical error in the summary chart in the EIS for lease-offering 135; the estimated impacts on wetlands in the 135 EIS are "Very Low," not "Low." This was identified in the main body of the EIS but incorrectly labeled in the summary chart. The MMS does not anticipate a large difference in impacts on wetlands between the base case and high case because the anticipated activities are built upon existing infrastructure (pipelines and canals) and no major onshore development is anticipated in either case. Potential effects are derived mainly from erosion that may occur because of the increased OCS vessel traffic in existing canals, above the expected traffic from other vessels such as fishing and recreational boats.

All of the assumptions and analyses used or developed in the EIS on potential effects on coastal habitats are based upon the best available scientific information on impacts on wetlands and other coastal ecosystems. The sections of the draft EIS that raised the concerns mentioned above have been reviewed by the analysts. Where the EIS would benefit from additional written information to clarify the basis, progression, or result of the analysis the EIS has been revised to provide this information.

The following discussion applies specifically to issues raised about the analysis of potential wetlands impacts in the Gulf of Mexico. It addresses concerns raised about the assumptions made regarding future, program-related activities and how those assumptions and the available scientific data were used to estimate wetlands impacts.

Due to the great expense of installing pipelines from the offshore and the fact that such lines require production from several leases to be economically feasible to install, the MMS does not make the assumption that pipeline landfalls will result from individual lease sales. The reason MMS does not project numerous new landfalls along the Louisiana coast is that many pipelines are already in place that can support new production.

Regarding the use of the wetlands loss assumption of 0.68 ha/km from Turner and Cahoon (1987), this applies only to pipeline canals in the Chenier Plain area or areas of the Gulf coastal region having similar geological features (firmer substrate, lack of sediment deficit). The Chenier Plain number is used for wetlands in Texas, Mississippi, and Alabama where most of the new landfalls are projected to occur. The 0.90 ha/km number that was applied to tidelands pipeline projects is the average of the numbers derived by Turner and Cahoon (1987) for impacts on the Chenier Plain and on the Deltaic Plain.

Regarding the discrepancy between the draft EIS wetlands loss values for the Gulf of Mexico region and those values contained within the SID for the proposal. A.T. Kearney, Inc. was contracted by the MMS to study and analyze the social costs of the proposed comprehensive program for use in the SID. The Kearney study analyzed the social costs of wetlands loss, while utilizing "older" data and assumptions (pre Turner and Cahoon) to arrive at its elevated values. Since the publication of these two documents, A.T. Kearney, Inc. has reevaluated the social costs based on more recent values.

The EIS assumed that indirect impacts from pipeline canals are greatly reduced as a result of backfilling the canal after the pipeline is installed. This reduces the possibility of salt water intrusion through the canal and the ponding effects of spoil banks.

The EIS assumed the most likely location for contact from an OCS offshore oil spill is along the western Louisiana/Texas coast. This was based on a consideration of nearshore and ocean circulation patterns, and the projected locations for development of petroleum resources associated with lease sales between 1992 and 1997. The distribution of oil resources developed on new leases will not likely be the same as in the past, given the increasing industry interest in deepwater areas and the increasing rates of abandonment of old fields in shallow waters.

Most impacts to coastal wetlands associated with OCS oil and gas activities have occurred from physical impacts rather than oil spill contacts. The MMS funded Turner and Cahoon (1987) to investigate the effects of oil and gas activities on coastal wetlands in Louisiana, and uses data from this study in the EIS to evaluate wetland impacts. That study estimated a range of 21,863 ha to 49,884 ha of wetlands lost in Louisiana from both direct and indirect impacts. The direct impacts (primarily from canal dredging) are expected to decrease greatly in Louisiana because of the abundance of existing infrastructure, and the projected decline in OCS production and activities during the life of the proposed action. The MMS does not consider the Turner and Cahoon estimate of indirect impacts from OCS activities to be adequate for conducting its EIS analysis of OCS indirect impacts because of the following:

- The Turner and Cahoon study did not document a relationship between salt water intrusion and marsh loss, nor between spoil banks and vertical rates of marsh accretion.
- The Turner and Cahoon study documented a greater than 50% reduction in the suspended sediment discharge of the Mississippi River since the 1950's, and a widespread accretionary deficit within the wetlands of coastal Louisiana—suggesting an emphasis on sedimentary deficits and subsidence as mechanisms for marsh loss. These assumptions were not brought into the study's methodology for assessing OCS indirect impacts.
- Turner and Cahoon indicated that OCS spoil banks may have been over estimated in their calculations because OCS canals and spoil banks tend to be large and thus more visible on remote sensing imagery.

- Because of several assumptions made by Turner and Cahoon, the study inappropriately allocated a proportion of the impacts of sediment deprivation and subsidence, processes many researchers believe to be the most important contributing factors to wetlands loss, to OCS canals.

For these reasons, MMS cannot validate the accuracy of the study's apportionment of indirect impacts to OCS canals, and does not consider the number a useful basis for preparing the environmental analysis.

The EIS assumes greatly reduced indirect impacts associated with OCS oil and gas activities in the future because of greatly reduced channel dredging and modern dredging practices which backfill pipeline canals after the pipeline has been installed in the ditch.

The final comment for this issue suggested using a holistic approach in the EIS rather than analyzing individual resources. The MMS uses as holistic an approach as possible to address the potential effects of the proposed action on the ecosystem. However, to provide a basis for analysis, the many major biotic and abiotic constituents comprising the ecosystem (such as individual species, water circulation, impacts on prey, and potential effects on habitat) need to be reviewed and analyzed separately. These constituent analyses are then linked, to the best degree possible, by the analysts to form an overall indication of the potential effects of the proposed action on major ecosystem components, such as coastal habitats, endangered species, marine habitats, or birds. Usually, however, as the analysis becomes more complex in linking various constituents the analysis becomes less certain because of the lack of scientific information on ecological linkages. Therefore, a balance must be struck between holistic ecosystem analyses and reliable scientific information.

ISSUE 27. Impacts on Protected Areas (Parks, Sanctuaries, Refuges, etc.).

a. Definition of Issue

Several commenters thought there should be a comprehensive discussion of environmental impacts from the OCS program, including projected oil spills, on existing and proposed areas of special environmental significance, such as national parks, monuments, preserves, refuges, and sanctuaries. It was recommended that other areas should also be discussed that have been designated by Federal, state, and local governments and private non-profit organizations. Concern was expressed that areas administered by the National Park Service receive consideration and protection throughout the subsequent processes involved in lease sales and plans of operations. A commenter was concerned with potential impacts from major oil spills and vessel traffic on marine sanctuaries and recommended that increased risks be factored into the cost/benefit analysis. A recommendation was made to note in the EIS that three national marine sanctuaries are of global significance since they are designated as World Biosphere Reserves and to include in the EIS a map showing the proximity of lease tracts to national marine sanctuaries. Some additions and corrections to sanctuaries and refuges on the visuals were also suggested.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; U.S. Dept. Of The Interior, National Park Service, Galvin; State Of California, State Lands Commission, Sanders; State Of California, Washington Office Of The Governor, Wilson; State Of Florida, Office Of The Governor, Chiles; State Of North Carolina, Dept. Env/Health & Nat. Res., Plan.& Asses., Flournoy; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; County Of Santa Cruz, California, Board Of Supervisors, Keeley; League Of Women Voters, Ventura County, California, Fellows; Sierra Club, Legal Defense Fund, Inc., Briggs; Perrin.

c. Response to Issue

This programmatic EIS is only the first of several environmental analyses on potential development of oil and gas resources on the OCS. At the program stage the scenarios are necessarily broad in scope. Consequently, most discussions are also broad regarding the location of potential impacts. For example, this EIS does not include site-specific analyses of all existing and proposed areas of special environmental significance that could be impacted by the OCS program because of the lack of specific information pertaining to possible future development. A sale specific EIS will be prepared before each sale on the schedule is held, and additional analyses of narrower scope will be done after a sale is held and before exploration and development and production take place. At these later stages, a greater degree of specificity can be attained because more specific information is known. At that time, areas of special environmental significance will receive more detailed consideration. This "tiering" approach to the analysis conforms with CEQ regulations (40 CFR 1502.20 and 1508.28).

The analysis in this programmatic EIS is organized on the basis of 14 resource categories to minimize repetition and improve the readability of the EIS. Even though existing and proposed areas of special environmental significance that could be impacted by the OCS program are not discussed in a separate category, they are considered in varying degrees in the appropriate resource categories though not all are specifically referenced.

The EIS does not contain any cost/benefit analyses; that subject is addressed in the SID. Section 4.C of Appendix 9 of the SID provides an assessment of the potential social costs of large spills for program areas. The risk of spill contact is a function of spill rates that are based on historical spill occurrences. The risk of spill contact is not a function of the sensitivity of the resource affected. Consequently, there wouldn't be an increase in the risk of contact because of the sensitivity of an area, such as a sanctuary. The EIS conclusions indicate the overall expected impact and take into account resource sensitivity.

At each stage in the development of the OCS program there is an appropriate environmental analysis and an opportunity for interested parties to review and comment on areas of their special interest and concern. These comments are then taken into consideration in future actions related to the proposal. All parties with responsibilities, interest, and/or concern in a certain area have the opportunity to monitor all future actions pertaining to that area.

The EIS has been revised to indicate that three national marine sanctuaries are of global significance since they are designated as World Biosphere Reserves (see Chapter III). A set of four visuals were issued at the time the draft EIS was released to aid in the review of the draft EIS. These visuals have been updated as suggested by some agencies and made a part of the final EIS.

ISSUE 28. Impacts on Fish Resources (Finfish And Shellfish).

a. Definition of Issue

A few of the commenters felt that some of the regional discussions (Atlantic and Gulf of Mexico) of fish habitats and communities in relation to oil and gas development activities were inadequate. A reviewer felt that the effects of produced water to migrating post-larval and juvenile fish in Louisiana coastal waters needs further discussion. Further discussion was also requested on the potential impacts of high explosives in platform removal to hard bottoms and platform piling ecosystems. One commenter noted that the draft EIS acknowledges that information on chronic and sublethal effects to fisheries is limited. Another reviewer felt that more identified data and methods are needed to support the draft EIS "low impact" analysis of the effect of chronic discharges on fisheries.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; State Of California, State Lands Commission, Sanders; State Of Louisiana, Department Of Natural Resources, Swan;

State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of North Carolina, Dept. Env/Health & Nat. Res., Div. Marine Fish., Hogarth; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; State Of South Carolina, Wildl. & Mar. Res. Dept., Mar. Res. Ctr., Burrell; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; Central Cal. Council Of Diving Clubs, Fhipps; League Of Women Voters, Dare County, North Carolina, Reporter; Public Awareness Committee For The Env., Alaska, Garoutte/winder; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, National OCS Subcommittee, Taylor; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Calcaterra; Gulf Breeze, FL Public Hearing, Testimony.

c. Response to Issue

The intent of the EIS is to analyze the reasonably foreseeable effects of oil and gas activities resulting from the proposed comprehensive program. The EIS is not meant to be "encyclopedic." Instead, generic impacts are discussed in Section IV.A. which is augmented in the Sections IV.D, IV.E, IV.F, and IV.H analyses with information specific to each region. The discussions for each region are considered to be adequate for a programmatic EIS. The information and analyses provided for each category will vary with each scenario, resources potentially at risk, and the information available for each region.

At this time no OCS produced waters are discharged in coastal waters. Since the writing of the draft EIS, the State of Louisiana has passed legislation which bans discharges of produced water into State waters. Through the new legislation this discharge, from any source, is to be decreased yearly so that complete cessation will be achieved by January 1, 1995. A discussion of the potential effects of produced water on fish species is summarized in Section IV.A.1. Because of the new legislation, the evaluation of this topic has been revised (Section IV.D). However, we feel that an adequate discussion was provided on the potential impacts on post-larval and juvenile fish in Louisiana coastal waters.

Regarding the comments on platform removal impacts, as described in Section IV.A.1.a, hard bottoms within 100 yards of platforms being removed could be destroyed or severely altered. However, as identified in Section IV.D.1 the seafloor habitat in the area of proposed OCS activity is predominantly muddy to sandy bottoms with rare occurrences of hardbottoms. Protection for the hardbottom area that may be near a platform designated for removal can be found in Appendix E, Assumed Mitigating Measures. Discussions in this document deal only with scenarios described for the proposed program. Loss of potential piling ecosystems with platform removal is a topic that will be further explored and subjected to NEPA analysis at the time a production plan is prepared.

Analysis in the EIS is conducted by using the best available information. Although more information may provide more specific details, it is felt that the information presently available provides adequate information to analyze reasonably foreseeable effects from the proposed program.

ISSUE 29. Impacts on Reptiles.

a. Definition of Issue

Commenters argued that the EIS conclusion is unsubstantiated when it states "the impact on marine turtles from oil spills is expected to be primarily sublethal, last less than one generation, with fewer than five deaths, which would be replaced through natural recruitment." In the commenters' opinion an oil spill in the western Gulf could foul the beaches at Rancho Nuevo, Mexico during nesting season and cause most of an entire generation of Kemp's ridleys to fail. Comments claimed no one can accurately predict the effects of oil spills on an individual species. This should be stated instead of minimizing the effects.

Another commenter stated the marine turtle impact conclusion was inconsistent with the conclusions in the previous 1987-1992 Program EIS and in the recent 131/135 sale-specific EIS.

Commenters were concerned whether the MMS was "affirmatively conserving" the Kemp's ridley turtle and it's habitat. They also requested information pertaining to the recovery plan for the ridley turtle, quantitative estimates of it's present population and methods used to derive these estimates.

Commenters stated it should be indicated in the EIS that sea turtles do not actively avoid oil spills and the oil spill scenario should include seasonal oil spills when sea turtles are on the nesting beaches.

Commenters indicated that loggerhead and green turtles nest in the Florida Panhandle area. They noted also that the Archie Carr National Wildlife Refuge in Brevard and Indian River counties in Florida hosts the largest concentration of nesting loggerheads and green sea turtles in the United States. Another comment indicated that sea turtles are not absent off North Carolina as implied in Section IV.D.1.b(7) of the EIS. Also, this section should incorporate NMFS's data and Epperly's review on sea turtles.

Another commenter requested MMS to document the source of the sea turtle stranding data cited in the EIS for the Gulf of Mexico Region.

Other commenters stated the analyses of the effects of pipe emplacement and spills on sea turtles was overlooked in Section IV.A of the EIS.

Another commenter suggested the estimate pertaining to vessel-related sea turtle injuries and the estimate of OCS-related vessel traffic in the Gulf of Mexico should appear earlier in the conclusion for this analysis.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; State Of Florida, Office Of The Governor, Chiles; State Of Louisiana, Department Of Natural Resources, Swan; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of South Carolina, Wildl. & Mar. Res. Dept., Mar. Res. Ctr., Burrell; Shell Oil Company, Beckmann; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Gulf Breeze, FL Public Hearing, Testimony.

c. Response to Issue

The statements concerning the effects of spilled oil on sea turtles are based on the best and most recent information available. The commenter is correct in that a quantitative estimate would be inappropriate. The statement considers a range of affected individuals and a range of impact duration. These ranges are reasonable assumptions based on the analyst's best professional judgment. The discussion of the effects of oil on sea turtles (Section IV.D.1.a(7)) does not minimize the adverse influence that an interaction with oil would have upon the resource. The location and prevailing longshore and offshore currents make it highly unlikely that an oil spill from U.S. offshore oil and gas activities in the Western Gulf would contact the Kemp's ridley nesting beaches in Rancho Nuevo, Mexico.

The conclusions for sea turtles in this 1992-1997 Program EIS and the previous 1987-1992 Program EIS, as well as other sale-specific EIS's, are basically different. The conclusions in this document are for regional sea turtles collectively, while the conclusions in the previous documents were on a planning area basis. Therefore, the conclusions of these documents cannot be directly compared with each other. Also the conclusions are presented differently in this document using a more direct statement that addresses the nature, magnitude, and duration of the expected impact. The impact conclusion "moderate" for the sea turtles in the 1987-1992 EIS and 131/135 sale-specific EIS was based on a definition that characterized the nature, magnitude, and duration of impacts somewhat differently than the current document. Consideration of the summary and conclusion statements in their full context indicates little difference in impact on the sea turtles of similar activities for the proposed actions. Also see Issue 3.

Under the Endangered Species Act the MMS is required to conserve and recover endangered species, such as the Kemp's ridley sea turtle, and does so through guidelines and prohibitions of certain OCS activities as described in Section IV.D.1.c(7) of the EIS. The MMS is not the federal agency mandated to promulgate recovery plans for endangered and threatened species. Quantitative population estimates for the ridley turtle are provided in Section IV.D.1.a(7) of the EIS. Population and stranding data from the Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) are used to derive quantitative estimates of the impacted populations and individual impacts. Statements concerning the effects of spilled oil on sea turtles are based on the best information available and the analysts professional judgment.

Section IV.D.1.a(7) of the EIS has been modified to indicate sea turtles do not actively avoid oil spills. This section indicates that the impact area and season of the year are some of the factors that may affect the severity of oil spills on turtles. This section also explains that sea turtles eggs are rendered infertile on contact with oil (Fritts and McGehee, 1982).

The appropriate sections in the EIS have been revised to incorporate additional information on loggerhead and green turtle abundance and nesting in the northeastern Gulf. Information pertaining to the presence of sea turtles off North Carolina is in Sections III.D.2.d, IV.D.1.a(7), IV.D.1.b(7), and IV.D.1.c(7). NMFS and Epperly's data are incorporated into Section III.D.2.d of the EIS.

The information pertaining to the age class of stranded sea turtles is documented in the EIS as Eckert, et al. 1989.

Regarding the comment about Section IV.A. overlooking certain aspects of sea turtle impacts, this generic section is a brief overview of potential impact producing factors from routine OCS activities and accidental oil spills. It is not intended to be a resource impact analysis based on a specific scenario. The potential impacts of pipeline emplacement and oil spills are thoroughly discussed with respect to sea turtles in Sections IV.D.1.a, IV.D.1.b, and IV.D.1.c of the Atlantic regional analyses.

The information presented in the analysis of vessel-related impacts on turtles is derived only from turtle stranding data and does not represent overall turtle mortality. Therefore, the conclusion does not imply that the expected effects from such interactions are more or less than what is stated.

ISSUE 30. Impacts on Birds.

a. Definition of Issue

Commenters stated the analysis of the effects of an oil spill on coastal and marine birds was flawed because it did not consider the potential impacts of a large oil spill contacting key bird habitat (e.g. nesting areas such as the Gulf National Seashore; feeding areas such as Delaware and Morro Bays; and migration staging areas such as the Copper River Delta).

Commenters suggested that it should be noted in the EIS that the analyses of potential impacts to shorebirds and seabirds that occur in Alaska are discussed in the subsequent Pacific section of the document.

Commenters requested the analyses of potential impacts of OCS oil and gas activities on several specific bird species in specific coastal habitats be incorporated into the EIS (e.g. the peregrine falcon in Morro Bay, California)

Commenters stated the EIS does not acknowledge that the Alaskan bald eagle populations are already depressed due to the *Exxon Valdez* oil spill or are already declining. Also the cumulative analysis for the bald eagle should discuss this population factor. Commenters stated that Appendix E of the EIS "Assumed Mitigation Measures" does not have a lease stipulation to provide safeguards for bird species and their habitats.

Commenters suggested that the analyses include additional discussion of the potential secondary effects of the routine disposal of drilling fluids, pipeline emplacement, and accidental oil spills on the habitat and food resources of migratory bird species.

Some commenters stated they could not accept the estimates of sublethal effects resulting in "no discernible decline in populations" equating this with a uniform comment of "no impact." Also the term "sublethal" effects on birds does not address their future breeding success.

Commenters questioned why the impact conclusions in this 1992-1997 Program EIS were inconsistent with previous EIS conclusions. Also they disagreed with the estimates of the nature, magnitude, and duration of effects used to describe impact conclusions.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Smith; U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; U.S. Dept. Of The Interior, National Park Service, Galvin; San Luis Obispo County Planning Dept., California, Euphrat; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of California, State Lands Commission, Sanders; State Of California, Washington Office Of The Governor, Wilson; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; Environmental Center, San Luis Obispo County, California, Kupper; Sierra Club, National OCS Subcommittee, Taylor; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Perrin; Stevens & 48 Signatories; Anchorage, AK Public Hearing, Testimony.

c. Response to Issue

Potential impacts to coastal and marine bird habitat such as breeding, feeding, nesting, resting, staging areas and migration routes are analyzed in the base, high, and cumulative cases for the proposed action (Section IV.D.1.a(5), IV.D.1.b(5), and IV.D.1.c(5)). The analysis of a large spill on key bird habitat is in Section IV.H. of the EIS. In an attempt to reduce redundancy and document size, the major discussion of bird habitat is in the base case analysis. These analyses are not repeated in the high or cumulative case analyses. However, the analyses and conclusions for the base case scenario are considered in the high and cumulative case analyses (as the impact conclusion for the proposed action). The analyses for the other resources in the EIS are discussed in a similar manner.

Several bird species migrate between or have inter-regional distributions in the Alaska and Pacific regions. To avoid duplicating the impact analyses for bird species in the document these analyses were combined into a single inter-regional analysis. These inter-regional analyses are in Chapter IV—Impacts on Marine and Coastal Birds within the regional subsections in which the bird species occur or have a larger population most of the time. An explanation of how the bird analyses are organized in the EIS has been inserted at the beginning of Section IV.D.1.a(5).

In the regional analyses for coastal and marine birds, if a particular bird species is not discussed, there are three possibilities: the bird may not occur or is rare in that region, the particular bird species is adequately accounted for in one of the broader categories (e.g. seabirds, or waterfowl), or the base case scenario indicated that no OCS-related activities would impinge on the bird's habitat area. Where appropriate the analyses on coastal and marine birds have been revised to incorporate additional information on the peregrine falcon, spectacled and Steller's eiders, bald eagle, piping plover, Xantus murrelet, and black storm petrel in the base case (Section IV.D.1.a(5)) of the EIS.

The base case analysis for the Alaskan bald eagle in Section IV.D.1.a(5) of the EIS provides some preliminary information concerning the effects of the *Exxon Valdez* oil spill on the Prince William Sound bald eagle population. Currently there is little definitive evidence that the bald eagle population in this area is depressed. The base case analysis and conclusion for the Prince William Sound bald eagle population are considered in the cumulative analysis for the Alaskan bald eagle population. Also see Issue 8.

The biological lease stipulations listed in Appendix E are intended to protect valuable biological resources. This would also include coastal and marine birds.

Some commenters indicated the discussion of generic impacts in Section IV.A of the EIS are an inadequate analyses of the potential secondary effects of offshore oil and gas activities on migratory birds and their food sources. This is true, the major impact analyses for migratory birds and their food sources are located in Section IV.D of the EIS. The analyses of the secondary effects of drilling fluids on prey species are located in Sections IV.A.1.b, IV.D.1.a(1), IV.D.1.a(6), and IV.D.1.a(5) of the EIS. Pipeline emplacement is found in Sections IV.A.1.a, IV.D.1.a(1), IV.D.1.a(5), and IV.D.1.a(8) and accidental oil spills in Sections IV.A.2, IV.D.1.a(1), V.D.1.a(5), IV.D.1.a(6) and IV.D.1.a(8) The generic impact information, though not specifically repeated in each resource analysis (to reduce redundancy) is considered in each resource analysis based on the regional oil and gas estimates, the base scenario for the proposed action or alternative, and the analysts professional judgment.

Sublethal effects are defined as short-term influences that impair the ability of an organism to function effectively without causing direct mortality. Therefore, sublethal effects may or may not prevent future breeding success of an individual bird or a flock of birds. A statement of “no discernible decline in a population” is not intended to imply “no impact.”

The estimates of the nature, magnitude, and duration of an environmental change used in the impact conclusions are statements of impact parameters which consider a range impact producing factor(s), a range of affected individuals, and a range of impact duration. These ranges are reasonable assumptions based on the best available information and the analyst’s professional judgment. Also see Issue 3.

The conclusions for coastal and marine bird species in this 1992-1997 Program EIS and the previous 1987-1992 Program EIS, as well as other sale-specific EIS’s, are basically different. The conclusions in this document are for regional bird species collectively while the conclusions in the previous documents were on a planning area basis. Therefore, the conclusions of these documents cannot be directly compared with each other. Also the conclusions are presented differently in this document with a more direct statement that addresses the nature, magnitude, and duration of the expected impact. The impact conclusion “moderate” for the brown pelican in the 1987-1992 Program EIS was based on a definition that characterized the nature, magnitude, and duration of impacts somewhat differently than the current document. Consideration of the summary and conclusion statements in their full context indicates little difference in impact on the brown pelican of similar activities for the proposed actions. Also see Issue 3.

ISSUE 31. Impacts on Marine Mammals.

a. Definition of Issue

The following summarizes comments concerning discussions in the EIS on marine mammals.

Commenters stated the EIS refers to the potential effects on specific areas, but does not account for potential effects on adjacent areas (e.g. the migratory paths for marine mammals and other resources are not listed).

Commenters indicated there is no or inadequate discussion in the EIS pertaining to significant increases and shifts in some sea mammal populations and behavior (e.g. whale, dolphin, elephant seal, and sea lion) along the Santa Maria Basin coastline.

Other comments indicated the EIS should provide a more site- specific analysis of the potential effects of offshore activities on marine mammals in the Channel Islands, Morro Bay, and Santa Maria Basin.

Some commenters stated they could not accept the estimates of sublethal effects resulting in "no discernible decline in populations" equating this with a uniform comment of "no impact." Also the term "sublethal" effects on marine mammals does not address their future breeding success.

Commenters indicated the EIS did not quantify freighter and fishing vessel traffic or marine mammal passage through Unimak Pass and did not assess the potential cumulative impact on marine mammals migrations, including the gray whale, of additional exploration vessel and tanker traffic.

Commenters stated the EIS did not examine the effects of seismic testing on marine mammals (specifically in the Santa Maria Basin) or for other species. Other commenters stated it is inappropriate to assume that seismic testing and development noise will not significantly alter the behavior of cetaceans.

Commenters stated the EIS ignores scientific evidence that suggests that bowhead whales will avoid drill rigs and other industrial activities and this suggests that OCS activities in the Arctic may disrupt bowhead migration. Commenters indicated it should be noted that migrating bowheads are more sensitive to disturbance than non-migrating whales.

Commenters believe the document has a strong bias in favor of leasing in the Arctic and expressed concern that the cumulative multi-generation impacts on the fragile arctic ecosystem could devastate not only the wildlife species themselves, but also the traditional Inupiat culture. Commenters stated the major impact producing agent on the bowhead whale population is not aboriginal whaling, but the persistent impact of commercial whaling nearly a century ago.

Commenters questioned the population estimate for beluga whales in Cook Inlet, stating there is no baseline data to indicate if the population is increasing or declining.

Commenters indicated the Steller sea lion population data in the draft EIS should be updated to indicate a 5 percent reduction (1990-1991) in the sea lion population between Kenai and Kiska, Alaska. It should also be indicated the National Marine Fisheries Service (NMFS) has established protective buffer zones around major Steller sea lion rookeries in Alaska and is developing a proposal to list critical habitat areas for this species. Commenters inquired that given the precipitous decline of the sea lion, how the estimated recovery period, from the effects of an oil spill was determined? Another concerned commenter indicated that the cumulative analyses needed to consider that sea lion populations are already declining. Comments were also raised about the location of the Stellar sea lion analysis in the EIS, including in Appendix F.

Commenters had the following comments pertaining to fur seals: The northern fur seal population on St. George continues to decline. Long term effects could be caused by oiling of these rookeries. The U.S. breeding population of northern fur seals south of Alaska, use portions of San Miguel Island as rookery area.

The following comments on sea otters were received. It should be noted that the California sea otter population is a distinct subspecies from the Alaska population. The EIS should assume oil spills will occur most frequently where oil activities are most concentrated. The EIS assumes oil spills will occur with uniform frequency and spatial distribution however, no additive effects from multiple spills are assumed. An oil spill impacting a local sea otter population could have a higher impact on the total population than indicated in the EIS. The EIS should distinguish the effect of two oil spill sizes on sea otter population, compare the 7,000 bbl spill with the 30,000 bbl spill to indicate range of mortality. Unexplained analysis of a pipeline spill is not a fair representation of cumulative impacts on otters. The impact analysis is inadequate, a spill could oil hundreds "not tens of otters" resulting in death of a majority of the otters contacted. This could seriously impact substantial portion of threatened southern sea otter and could depress sea otter populations for decades. A map showing existing platforms, pipelines, and proposed lease blocks in relation to sea otter distribution should be added to EIS. Commenters indicated that the final EIS should provide additional information on the effects of the oil spill in Prince William Sound on marine mammal populations and indicated their estimated recovery rates. About 350 otters oiled in the Alaska spill were caught and treated; how many of these otters survived? Concluding statements such as primarily sublethal "effects" or "replaced by natural recruitment" have little/no scientific basis. There are no long-term studies to determine effects only of oil.

A commenter suggested the discussion on marine mammals in the EIS should include the endangered Florida manatees.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Dept. Of The Interior, Fish And Wildlife Service, Smith; U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; U.S. Dept. Of The Interior, National Park Service, Galvin; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders; State Of California, Washington Office Of The Governor, Wilson; State Of Florida, Office Of The Governor, Chiles; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; Assoc. Of Monterey Bay Area Governments, California, Nunn; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; County Of Santa Cruz, California, Board Of Supervisors, Keeley; North Slope Borough, Alaska, Mayor, Kaleak; Bering Straits Native Corporation, Alaska, Martin; Environmental Center, San Luis Obispo County, California, Kupper; Friends Of The Sea Otter, California, Schiavone; Greenpeace, Washington, D.C., Alexander; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, Legal Defense Fund, Inc., Briggs; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Chandler; Perrin; Stevens & 48 Signatories; Anchorage, AK Public Hearing, Testimony.

c. Response to Issue

Regarding the discussion of migratory paths for marine mammals in the EIS, with a few exceptions the EIS analyses were developed from a regional species- or species-group specific perspective rather than an area-specific one. The intent in this Comprehensive Program EIS was to focus on potential regional and inter-regional effects rather than on specific areas at risk, which will be done in subsequent sale-specific EIS's. The discussion of all marine mammal species or species groups in Chapter III includes descriptions of summer and winter ranges as well as migratory routes and seasonality.

Regarding the comment on inadequate discussion of marine mammal populations in the Santa Maria Basin, population data for marine mammals which occur in the Santa Maria Basin are discussed in the EIS in Sections III.C.2.a(1) and III.C.2.a(2). The observation of increases and shifts in wildlife populations over time is a normal occurrence. These population shifts are usually related to natural causes (e.g. shifts in oceans currents, seasonal migration, food availability, weather patterns, etc.)

Regarding inadequate discussion of marine mammals occurring in the Santa Maria Basin, several marine mammal species migrate between or have inter-regional distributions in the Pacific and Alaska regions. To emphasize the migratory nature of these species and avoid duplicating the impact analyses for these species in the document, these analyses were combined into a single inter-regional analysis. These inter-regional analyses are in Section IV.D.1.a(3) "Impacts on Marine Mammals" within the region (Pacific or Alaska) in which the marine mammal species occur or have a larger population most of the time. Regarding the comment on inadequate discussion of marine mammal behavior in the EIS, some behavior information (e.g. breeding, nursing, feeding, migration, avoidance, acclimating, etc.) for marine mammals is in Sections III.C.2.a(1), III.C.2.a(2) and IV.D.1.a(3) either in the Pacific or Alaska regional analyses. This Comprehensive Program EIS is intended to evaluate the effects of a broad national planning program and to analyze the potential impacts of the proposed action on a regional basis, (e.g. the Pacific OCS Region) rather than a specific habitat basis (e.g. Santa Maria Basin) and on broad resource topics (e.g. Marine Mammals) rather than specific species. However, some specific endangered and threatened marine mammals are discussed in more detail in the EIS. A more detailed, sale-specific, EIS will be prepared for the proposed Southern California lease sale to evaluate the potential effects of the proposed action on marine mammals in smaller areas (e.g. Santa Maria Basin and the Channel Islands). Also see Issue 6.

Sublethal effects are defined as short-term influences that impair the ability of an organism to function effectively without causing direct mortality. Therefore, sublethal effects may or may not prevent future breeding success of an individual marine mammal or pod of marine mammals. The statement of impact prediction considers a range of affected individuals and a range of impact duration. These ranges are reasonable assumptions based on available scientific data, the scenarios, and the analyst's professional judgment. A statement of "no discernible decline in a population" is not intended to imply "no impact." It is intended to indicate that the potential loss of one or more individuals cannot be distinguished from natural mortality and that wildlife population estimates are "estimates," not finite.

At the program stage, the freighter, fishing vessel and marine mammal traffic through Unimak Pass are not quantified. More site-specific and species-specific information would appear in a sale-specific EIS for the Alaska and Pacific Region. However, the potential impacts of OCS-related routine support vessel traffic on marine mammals are discussed generically in Section IV.A.1 and IV.A.2 and Table IV.A-1. The inter-regional analysis for the migratory gray whale is in Section IV.D.1.a(3) (Pacific Region). It is not repeated in Alaska Region (see the first and second response above and Issue 6). The cumulative inter-regional analysis for the migratory gray whale is in Section IV.D.1.c(3) (Pacific Region). Given the current level of vessel traffic through Unimak Pass, the prior and estimated future levels of OCS activities in the Alaska and Pacific regions, the fact that gray whales still migrate through the Pacific Region, Unimak Pass, and the Alaska Region twice a year, and that their population is increasing about 2.5 percent a year, there doesn't appear to be a significant impact on the eastern Pacific gray whale population from vessel traffic.

The potential impacts of seismic surveying on marine mammals and other species is discussed generically in Section IV.A, which states "that acoustic stimuli may modify animal behavior and physiology depending on the species, with possible adverse effects on fish, sea turtles, and marine mammals." The discussion of seismic testing on a species basis is within Sections IV.D.1.a(3), IV.D.1.a(6), and IV.D.1.a(7). Also see Issue 6. Scientific evidence that pertains to whales responding to underwater noise suggests that whales will avoid noises associated with drilling rigs and industry activities. However, there is no scientific evidence that supports the theory that noise of any type would disrupt whale migrations. The scientific evidence supports only minor, short-term, and localized avoidance of underwater noise. Scientific studies of whales (many different species) have been conducted from California to the Beaufort Sea and on the East coast. In every case, whales have been observed to respond to similar noise in a similar fashion, regardless of their behavioral mode. It is true that bowheads tend to be somewhat more sensitive; but recent studies show that it is not so much the noise or the behavioral mode that dictates the response. It is far more the threat or lack of threat as perceived by individual whales.

The scientific data used in the EIS analyses concerning the bowhead whale and other marine mammals indicate that the effects on these species would be as indicated in the EIS. No attempt was made to exemplify a bias of any kind. The annual harvest of bowhead whales by Native subsistence whalers is one of the primary impacting agents. The percentages presented in the analysis represent the professional judgment of the analyst using available data and assumed levels of activity as presented in the scenarios.

The informal count of a minimum of 300-500 beluga whales by the Alaska Department of Fish and Game was in 1964-1965 and did not account for whales submerged and not seen by the surveyors. Calkins (1989) reported a minimum direct count of 479 whales on a single day. Applying the 2.7 correction factor to this count would equal an estimate of about 1,300 whales. This figure represents the most current published estimate for the Cook Inlet population but does not necessarily mean that the population has increased over the 1964-1965 count, nor does it indicate a decrease in the population.

Concerning comments on the Stellar sea lion, the 1991 population data and information that NMFS has established buffer zones around principal Steller sea lion rookeries and is currently developing a list of critical habitats for the sea lion has been added to Sections III.B.2.a(1) and IV.D.1.a(3) of the EIS. Under "typical" circumstances, a population is expected to return to its pre-spill level within the estimated interval given. This estimate is complicated by the sea lion's severe decline and is likely to preclude accurate estimates of post-spill recovery. Few of the activities associated with offshore oil exploration and development are likely to take place near the remaining centers of sea lion abundance. Although in a reduced and declining population any mortality should be viewed as a serious problem, we do not expect significant mortality to result from an OCS-related oil spill unless it were to impact a major rookery. If the population is unable to recover in the near future from unknown factors currently causing its decline, it would seem an estimated recovery period of 6 generations or more (minimum of 36 years) from potential effects of an event likely to occur is a reasonable estimate. However, because little definitive information concerning accurate estimates of recovery times for this species exists, the text has been revised to reflect this uncertainty. Because several relatively unquantified variables are involved in estimating the potential recovery interval from an oil spill, the estimate given represents our best projection using the information available. If the maximum estimated recovery interval is used, an average increase in pup production of approximately 2 percent is required. If a post-spill cleanup effort occurs comparable to that following the *Exxon Valdez* oil spill, significant mortality or other effects are not expected to occur more than 1 year later. The precipitous decline of the sea lion is discussed and considered in the cumulative analyses for marine mammals. The Steller sea lion is discussed separately because it's an endangered species. The topics in Appendix F. have been renumbered so the discussion on sea lions follows pinnipeds. The analysis of potential impacts on sea lions for the Pacific northwest area is discussed in the Alaska Region base case in Section IV.D.1.a(3).

The San Miguel Island population of fur seals is referenced in Sections III.B.2 and IV.D.1 of the EIS. A statement of potential effects of spilled oil contacting fur seals on the Channel Islands has been added to the EIS. These effects are expected to require three or more generations for recovery if contact occurs in the breeding season. The best available information concerning generation interval, population size and distribution, seasonal movements of individuals, known concentration areas, probability and number of oil spills likely to occur, probable movement pattern of a spill, and season of spill occurrence, is combined to yield an estimate of what interval MMS would expect recovery of a population to require. Safety equipment and procedures and lease stipulations in place in oil-field development elsewhere on the OCS have resulted in a low probability of exposure to oil spills.

The discussion of potential oil spill impacts to the California sea otter population points out the uncertainty involved in predicting the magnitude of mortality likely to occur as a result of the proposed action. The base-case scenario assumes the occurrence of a pipeline spill of 7,000 bbl of oil off the coast of southern California. It was estimated from a model developed by Ford and Bonnell (1987) that a pipeline spill of 7,000 to 10,000 bbl magnitude could oil 30 kilometers of coastline. To enhance the specificity of the analysis it was further assumed that the spill would contact the shoreline along a 30 kilometer stretch extending between the Santa Maria River (southern limit of the sea otter range) and Point Buchon. Recent information (R. Jameson, FWS, pers. comm., January 17, 1991b) indicates that approximately 300 sea otters, or about 13 percent of the current population, inhabit this area. It is unlikely that all sea otters in this area would die as a result of the spill, but recovery from the loss of 15 percent of the population would take about 3 years at an annual growth rate of 5 to 7 percent.

The discussion and analysis of the Florida Manatee is in Sections III.D.2.a(1) and IV.D.1.a(3) respectively under the Atlantic Region of the EIS. The scoping section (Section I.B) explains why the manatee is not analyzed in the Gulf of Mexico.

ISSUE 32. Impacts on Terrestrial Mammals.

a. Definition of Issue

Commenters stated that potential impacts of offshore gas and oil activities on the endangered Choctawhatchee beach mouse and it's habitat in Walton and Bay Counties in Florida should be included in the analyses for the Gulf of Mexico Region in the EIS.

Commenters indicated that in addition to caribou, several other species of Alaskan terrestrial mammals could be impacted by marine oil spills resulting from OCS activities including Alaskan black bear, brown bear, sitka deer, river otter, mink, foxes, and other species which commonly feed or travel in the intertidal areas and should be included in the impact analyses for the Alaska Region.

Some commenters noted there was no analysis of the impacts on terrestrial mammals for the Pacific Region in the draft EIS,

specifically, the badger and the endangered Morro Bay kangaroo rat and it's coastal habitat.

b. Issue Was Raised by

U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, Ga, Williams; San Luis Obispo County Planning Dept., California, Euphrat; State Of Alaska, Div. Of Government Coordination, Rusanowski; State Of Florida, Office Of The Governor, Chiles; County Of San Luis Obispo, California, Board Of Supervisors, Blakely.

c. Response to Issue

Information pertaining to the endangered Choctawhatchee beach mouse which occurs in Walton and Bay Counties, Florida has added to the appropriate sections in the final EIS.

Many terrestrial mammals that occur in coastal areas are not analyzed in the EIS because it was determined during the scoping process that they would not be affected at all or would not be affected significantly by the proposal (see Section I.B).

No new onshore construction projects (e.g. pipelines, heliports, processing facilities) are assumed for the proposal in the Pacific Region. Therefore terrestrial mammals are not expected to be at risk from this proposed action.

ISSUE 33. Impacts on Endangered or Threatened Species.

a. Definition of Issue

Commenters requested that additional population and habitat information for the endangered Choctawhatchee beach mouse and Gulf sturgeon be added to the Gulf of Mexico environmental analyses.

Commenters stated that in the analyses of endangered or threatened coastal and marine birds, specific species (e.g. the brown pelican, California least tern, peregrine falcon, and snowy plover) and their specific habitats (e.g. the Santa Maria Basin and/or the Channel Islands) are either inadequately discussed or not discussed.

Commenters indicated the descriptions and analyses concerning endangered and threatened marine mammals (e.g. cetaceans, sea otters and pinnipeds) in the Santa Maria Basin were inadequate and that it is not clearly stated in the EIS that many endangered cetaceans inhabit or traverse the Santa Maria Basin. These commenters also argued that the EIS does not discuss the behavior patterns of gray whales and sea otters in the Basin. Some comments stated the EIS includes an inadequate analysis of "rare and unique" species.

Other commenters suggested that the EIS should discuss the impact of the sea otter relocation plan and should use the data from the most current sea otter population survey. It was recommended that the document discuss growth rate and diet data for the endangered Guadalupe fur seal.

Commenters stated the EIS failed to address the full range of endangered animal and plant species that inhabit estuarine areas in Santa Barbara and San Luis Obispo counties that may be affected by the proposed action.

A commenter disagreed with the "will not affect" assessment for the effect of aircraft noise on endangered birds in Section IV.D.1.a(5) of the EIS. The commenter stated no one is enforcing minimum flight ceilings over Matagorda Island, Texas which is important habitat for the endangered whooping crane and piping plover.

Commenters stated the analyses of endangered marine mammals for the Atlantic Region ignores the fact that the proposed lease area is in the migratory route of the northern right whale. Also there are no scientific base-line studies to support the analyses and endangered species are ignored or brushed off in the draft EIS.

b. Issue Was Raised by

U.S. Dept. Of The Interior, Fish And Wildlife Service, Atlanta, GA, Williams; State Of California, Washington Office Of The Governor, Wilson; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Central Cal. Council Of Diving Clubs, Fhipps; Environmental Center, San Luis Obispo County, California, Kupper; Environmental Defense Center, California, Chytilo; Sierra Club, Lone Star Chapter, Mannchen; Long Branch, NJ Info. Mtg., Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

Additional information on the endangered Choctawhatchee beach mouse and Gulf sturgeon were added to the Gulf of Mexico environmental analyses in Sections III.A.2.b and III.A.2.d and IV.D.1.a(4) and IV.D.1.a(6) of the final EIS.

The endangered brown pelican and California least tern are specifically discussed for the Southern California Planning Area which includes the Santa Maria Basin and the Channel Islands. The sensitivity of coastal and marine birds (e.g. brown pelican and California least tern) to oil spills has been adequately discussed in Sections IV.A.2 and IV.D.1.a(5) for use in making a decision on the proposal program. Other bird species (e.g. peregrine falcon) are either discussed in the Alaskan section of the analyses (same section as above) or are discussed under a general subheading such as shorebirds (e.g. snowy plover), in the same section as above. This Comprehensive Program EIS is intended to evaluate the effects of a broad national planning program on a regional basis, (e.g. the Pacific OCS Region) rather than a specific habitat basis; and on broad resource topics (e.g. Coastal and Marine Birds) rather than specific bird species. However, some specific endangered and threatened birds are discussed in more detail in the EIS. A more detailed, sale-specific, EIS will be prepared for the proposed Southern California lease sale to evaluate the potential effects of the proposed action on smaller areas (e.g. Santa Maria Basin and the Channel Islands). Also see Issue 6.

Several endangered marine mammal species migrate between or have inter-regional distributions in the Pacific and Alaskan regions. To avoid duplicating the impact analyses for these endangered species in the document these analyses were combined into a single inter-regional analysis. These inter-regional analyses are in Section IV.D.1.a(3) "Impacts on Marine Mammals" within the region in which the endangered mammal species occur or have a larger population most of the time. This is also true of the endangered bird species. In the regional analyses for endangered birds and marine mammals, if a particular endangered species is not discussed, there are three possibilities: 1) the endangered species may not occur or rarely occurs in that region, 2) the particular species is adequately accounted for in one of the broader categories (e.g. seabirds or pinnipeds), 3) or the base case scenario indicated that no OCS-related activities would impinge on the endangered species habitat as a result of the proposed action. It is not clear what species the commenters consider to be "rare and unique" that are not already analyzed in the EIS under threatened or endangered species, or under one of the more general topic headings (e.g. mammals, birds, fish, or reptiles).

The impacts of the revised Southern Sea Otter Recovery Plan are not analyzed in this EIS because the plan is not a part of this proposed action. The reason the U.S. Fish and Wildlife Service listed the southern sea otter as a threatened species was concern over the possibility of a tanker spill in central California. Growth rate and diet information for the Guadalupe fur seal is cited in Section III.C.2.a(1) of the EIS. Additional species-specific data on the Guadalupe fur seal is not required for analysis of the proposed action on a regional basis. Also see the second response above and Issue 6.

Regarding the comment about the full range of rare, protected, and endangered plant and animal species that inhabit estuarine areas in Santa Barbara and San Luis Obispo counties, as discussed in the second paragraph above, the Proposed Comprehensive Program EIS is intended to evaluate the effects of a broad national planning program, and analyze the potential impacts of the proposed action on a regional basis and on broad resource topics. The level of detail in the Proposed Comprehensive Program EIS is appropriate for the scope of this document. Some species and habitats are not discussed in detail if the activity scenario indicated they would be not significantly affected. Some specific inter-regional endangered and threatened species are analyzed in detail in either the Alaskan or the Pacific sections of Chapter IV, but not in both, to reduce redundancy. Estuarine species of the Southern California Planning Area are discussed generically in Section III.C.2.e (Coastal Habitats) under "Wetlands and Estuaries." Potential impacts to coastal habitats are analyzed in Section IV.D.1.a(8) of the EIS.

Regarding the comment about the effects of aircraft noise on endangered birds, the "will not affect" assessment is based on the following information. The MMS through a "Letter to Lessees" (LTL dated 8-30-90) informed all lessees and operators in the Gulf Region of an Interagency Agreement between the Fish and Wildlife Service (FWS), the National Park Service (NPS), and the Federal Aviation Administration (FAA). In the agreement the FAA established a minimum flight altitude of 2000 feet for aircraft flying over national wildlife refuges and national parks located in the coastal region of the Gulf of Mexico. Pilots who fly over these areas at less than the established 2000 ft altitude may be subjected to one or both of the following: 1) The penalties referenced at 50 CFR 28.31 and imposed by the FWS for conducting prohibited acts as described at 50 CFR 17.34. and/or 2) The penalties described at 36 CFR 1.3 and imposed by the NPS for commission of prohibited acts as listed at 36 CFR 2.1. Therefore, the FWS, NPS, and FAA are the agencies responsible for enforcing this regulation. If any aircraft are observed flying below the 2000 ft minimum altitude over a coastal national wildlife refuge or park, the registration number from the aircraft's wing or side of the fuselage should immediately be reported to the nearest FWS, NPS, and FAA offices. Additional information has been included in Section IV.D.1.a(5) of the final EIS.

Regarding the comments on the right whale, baseline studies, and endangered species, Section III.D.2.a(1) of the EIS describes the migration routes of the endangered right whale in the Atlantic Region. The marine mammal analyses in Section IV.D.1.a(3) (Atlantic Region) of the EIS specifically addresses the migration routes of the endangered right whale and analyzes the routing of pipelines and other potential routine and accidental impacts on the right whale. For over a decade the MMS (and it's predecessor agency) has conducted a variety of major oceanographic research studies costing over $500 million, many of which have been dedicated to establishing baseline information. Some of the data cited in the discussion and analyses on endangered species were derived from these studies (e.g. Geraci and St. Aubin, 1982; CETAP, 1982; Fritts et al, 1983). Also the reference section in Chapter VI of this document lists several additional research studies on endangered species, some specifically pertaining to the right whale, and several funded by MMS. The descriptions and analyses for endangered species (in Chapters III and IV respectively) are specifically addressed under the appropriate headings for marine mammals, terrestrial mammals, marine and coastal birds, fish resources and reptiles.

ISSUE 34. Impacts on Archaeology.

a. Definition of Issue

Commenters were concerned that the amount of data MMS has for archaeological resources on the OCS is inadequate. One commenter stated that more emphasis needs to be placed on archaeological resources in the MMS environmental studies program, specifically for the Alaska Region where no comprehensive archaeological baseline study exists. Another commenter felt that the level of potential impacts to archaeological resources had been minimized. Several commenters felt that there was insufficient information on the Chumash culture of southern California included in the archaeological analysis.

b. Issue was raised by

U.S. Dept. Of The Interior, National Park Service, Galvin; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders; State Of Texas, Historical Commission, Bruseth; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; Citizens Assoc. Of Bonita Beach, Florida, Ward; Environmental Center, San Luis Obispo County, California, Kupper; Perrin; Stevens & 48 Signatories.

c. Response to Issue

The MMS recognizes the importance of archaeological resources and historic properties on the OCS, and has conducted comprehensive baseline studies on all OCS areas with the exception of Alaska. The MMS environmental studies program includes a system whereby numerous proposed studies for all types of environmental issues are evaluated and ranked in relation to each other. Although a comprehensive archaeological baseline study for the Alaska Region has not yet been completed, in-house archaeological evaluations including a "Prehistoric Resource Analysis" and a "Historic Shipwreck Analysis" are completed and published in each sale-specific draft EIS for public review and comment.

The MMS has completed archaeological baseline studies on all portions of the continental shelf except Alaska. As a result of these studies, MMS has compiled all existing information on the locations of known historic and prehistoric archaeological sites on the continental shelf (including State waters). These baseline studies also include a compilation of existing geologic, geographic, and geophysical information which is used to determine where additional archaeological sites are most likely to occur on the continental shelf. In order to help protect known sites, their specific names and locations are not given in the draft EIS. In order to locate and assess the many potential archaeological resources which probably exist on the continental shelf, but which have not yet been discovered, MMS requires lessees to conduct remote sensing surveys within areas identified by the baseline studies as having any potential at all for the occurrence of historic or prehistoric archaeological resources. These surveys are required after leasing on specific lease tracts and a detailed archaeological analysis is done at this point, prior to permitting any lease activities. If any indication of a potential archaeological resource is located as a result of the remote sensing survey, the lease operator is required to either move lease operations to avoid the potential resource, or to conduct additional investigations of the potential archaeological resource to determine whether or not it is significant. These detailed remote sensing surveys are thorough but costly, therefore, they are conducted only on the specific leases to be explored, and this can be done only after a lease sale.

Regarding the comment about addressing the concerns of the Chumash, significant issues, such as subsistence activities along the California coast, were identified through scoping for analysis in the EIS. Other specific concerns of particular native Americans were considered beyond the scope of this EIS.

ISSUE 35. Impacts on Military Uses.

a. Definition of Issue

Two commenters stated that the draft EIS fails to adequately consider the existing or anticipated uses of the sea and seabed, including military areas.

b. Issue Was Raised by

U.S. Dept. Of The Air Force, AFDTC, Eglin Air Force Base, Arnold; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; City Of Laguna Beach, California, Mayor, Fitzpatrick; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

Information concerning the existing and anticipated uses of the sea and seabed for military purposes is included in Section IV.B.1, Military Use Areas. This section discusses the types of military uses, location of such uses, potential impacts to military and NASA activities, impacts to OCS activities, USDOD policy regarding use of the OCS, and general provisions of regulations (32 CFR 252) and Memorandum of Understanding pertaining to use of the OCS.

ISSUE 36. Impacts on Recreation and Tourism.

a. Definition of Issue

Local governments expressed concern about potential oil spill impacts on the local recreation and tourism industry and noted that the EIS analysis is too superficial and does not give "adequate representation" to potential impacts. One commenter questioned the lack of an assumption and consideration of accidental spills and noted that any potential for adverse effects would render the proposed action objectionable.

A commenter recommended that the effects on aesthetics be identified as an unavoidable impact.

b. Issue Was Raised by

U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; San Luis Obispo County Planning Dept., California, Euphrat; State Of California, Coastal Commission, Hansch; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of North Carolina, Dept. Env/health & Nat. Res., Plan.& Asses., Lewis; Town Of Ocean City, Maryland, Mayor, Powell; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; County Of Mendocino, California, Board Of Supervisors, De Vall; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Port San Luis Harbor District, CA, Board Of Commissioners, Leane; Citizens Assoc. Of Bonita Beach, Florida, Ward; Environmental Center, San Luis Obispo County, California, Kupper; Environmental Defense Center, California, Chytilo; League Of Women Voters, Dare County, North Carolina, Reporter; League Of Women Voters, Oregon, Eaton/Cottingham; Krupp; Long Branch, NJ Info. Mtg., Testimony; Santa Maria, CA Public Hearing, Testimony; Wilmington, NC Public Hearing, Testimony.

c. Response to Issue

The EIS is intended to serve as an aid to decisionmaking for a 5-year program on a national scale with related activities extending over 30 years or more. The analysis examines that which is "reasonably foreseeable" within that framework. It is not intended to represent the worst possible impact to a local tourist industry, but it is a reasonable estimate of likely impacts on a regional scale given the assumptions contained in the scenario.

The analysis does indeed assume spills for analytical purposes within the context of the scenario's hypothetical components. These assumptions are based upon observation of historical incidents. The conclusions are not intended as blanket statements, but they are built upon these observations. For a programmatic EIS, sufficient detail has been provided for the decision to be made. It would be inappropriate to estimate the specific impact to a particular locale in the absence of additional information which will become available at the lease sale stage and the exploration, development, and production phases. At those times, more specific environmental analysis will be conducted.

Any potential for adverse effects may be perceived as a threat, and objections to oil and gas activities built upon the existence of this potential are recognized. However, the elimination of all risk associated with OCS oil and gas activities is simply not possible.

The section entitled "Unavoidable Adverse Environmental Effects" has been revised to include effects on aesthetics.

ISSUE 37. Impacts on Fishing (Commercial and Recreational).

a. Definition of Issue

Several reviewers expressed concern that there is inadequate consideration of other uses of the sea and seabed, including fisheries, in the draft EIS. Discussion of potential impacts to Monterey Bay by a local spill was requested. It was requested that MMS acknowledge its role in wetlands loss and therefore, its contribution to the low stock level of several fish species in the Gulf. One reviewer considered the draft EIS discussion on OCS activity-related employment patterns and the direct link to overfishing of Gulf stocks to be superficial.

The Pacific Region's estimates for population recovery were thought to be optimistically short and without support. Resources which are the biological support to fisheries will be directly impacted by OCS activities to an unknown magnitude. The discussion on this subject was considered to be inadequate.

Concern was expressed that the Fishermen's Contingency Fund is slow in correcting problems and compensating for damaged equipment, which leads to further loss of income to a fisherman. The EIS, it was suggested, should point out that the Fisherman Contingency Fund is not designed to compensate the fisherman for loss of available catch or to mitigate damage to habitat as a result of OCS activities. Commenters disagreed with the draft EIS's characterization of potential impacts from oil development in the Pacific Region as an inconvenience to fisherman. Fishermen regard the potential impacts as being moderate to large level. Small family businesses cannot sustain several years of loss due to "inconveniences."

Further discussion was requested in the Atlantic Region of the effects on recreational fishing as a result of displacement and an analysis of economic impacts from a spill. Another reviewer felt insufficient consideration was given to the impact of a publicized spill. The reviewer felt that there could be an economic loss due to reduced marketability of resources perceived to be tainted.

b. Issue Was Raised by

U.S. Dept. Of Commerce, National Oceanic And Atmospheric Admin., Cottingham; U.S. Environmental Protection Agency, Office Of Federal Activities, Sanderson; State Of California, Coastal Commission, Hansch; State Of California, State Lands Commission, Sanders; State Of Louisiana, Department Of Natural Resources, Swan; State Of Louisiana, Department Of Natural Resources CMD, Howey; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; State Of South Carolina, Wildl. & Mar. Res. Dept., Env. Evaluat., Settle; State Of South Carolina, Wildl. & Mar. Res. Dept., Mar. Res. Ctr., Burrell; Virginia Institute Of Marine Science, College Of William And Mary, Byrne; City Of Laguna Beach, California, Mayor, Fitzpatrick; City Of Monterey, California, Community Development, Wojtkowski; City Of Morro Bay, California, Mayor, Sheetz; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Cruz, California, Board Of Supervisors, Keeley; Port San Luis Harbor District, CA, Board Of Commissioners, Leane; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Bering Straits Native Corporation, Alaska, Martin; Central Cal. Council Of Diving Clubs, Fhipps; League Of Women Voters, Oregon, Eaton/Cottingham; Oil Reform Alliance, Alaska, Ott; Sierra Club, Lone Star Chapter, Mannchen; Sierra Club, National OCS Subcommittee, Taylor; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Chandler; Krupp; Anchorage, AK Public Hearing, Testimony; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

We assume the commenter meant that the EIS should address two issues when discussing "other uses of the sea and seabed": first, conflicts between OCS oil and gas activity and other uses; and second, possibly the cumulative effects of multiple uses of the sea and seabed. The EIS does deal with both issues. In the EIS analysis is a discussion on the conflicts between oil/gas activities and fishing, navigation, recreation, and subsistence, in particular. The cumulative analysis section (Section IV.D.1.c), considers the effects of the uses already mentioned as well as other uses of the sea and seabed, not related to OCS activities.

The EIS does recognize that OCS activities contribute somewhat to wetland loss (see Section IV.D.1.a). The analysis concludes however, that the major causes of wetland loss in the north central Gulf are sediment deprivation and rapid coastal subsidence. The EIS does recognize the importance of wetlands to fisheries as habitat and nursery grounds. A description of Coastal Habitats can be found in Chapter III.

In regard to the draft EIS saying that OCS-related employment patterns have a direct link to overfishing of Gulf stocks, it would be difficult to draw a direct causal relationship between increases in employment due to OCS activities and overfishing. An analysis of a "boom/bust" cycle is not included in the EIS; however, such an analysis has been added to the Secretarial Issue Document for the final program (see Section I.B).

When preparing an analysis of potential impacts, in this case fish population recovery rates, the latest information available is used. In the analysis, recovery rates in the EIS are based on potential impacts to biological resources which support fisheries, as well as direct impacts to fish resources.

Biological support for fisheries in the Pacific region would be susceptible to the same potential activities and events that could directly impact the fisheries. The analyses of potential direct impacts encompasses the loss of food sources. More specific analyses of impacts on fisheries can be found in the cumulative discussion where OCS and non-OCS potential impacts are addressed. The Fishermen's Contingency Fund was created as an effort to counteract potential impacts to fishermen, such as equipment loss, due to OCS oil and gas activities. The draft EIS stated in the Executive Summary, page vi, that offshore activities are expected, "at a minimum", to cause "inconveniences" to fishermen.

In fact, the analyses concluded that some loss in employment could occur in the fishing industry in the Alaska and Pacific Regions. The draft EIS is a broad, national, programmatic document that addresses issues that would scale 30 or more years of OCS oil and gas activity. The NEPA analyses at later stages, such as the lease sale stage, would be more specific in terms of effects on the fishing industry in particular states and localities.

The discussion in the Proposed Comprehensive Program EIS on the potential impacts on fishing associated with OCS oil and gas activities is appropriate for the scope and intended purposes of the document. Impacts discussed address effects on recreational fishing as a result of displacement by OCS affiliated activities.

An analysis of economic impacts from a spill can be found in the Secretarial Issue Document, in particular the Summary of Estimated Potential Social Costs, and Appendix 8: Economic Analysis of Environmental Costs.

ISSUE 38. Impacts on Demographics and Employment.

a. Definition of Issue

Several commenters noted that the EIS analysis of socioeconomic issues often failed to exploit the extensive information available on the subject. Further, it was noted that, in some cases, the analysis of socioeconomic impacts on coastal communities was altogether absent. In particular, commenters noted the lack of a discussion of the economic phenomena referred to as "boom/bust."

b. Issue Was Raised by

Port San Luis Harbor District, California, Moffitt; State Of California, Washington Office Of The Governor, Wilson; State Of Florida, Office Of The Governor, Chiles; State Of Louisiana, Department Of Natural Resources, Swan; State Of Louisiana, Department Of Natural Resources CMD, Howey; State Of North Carolina, Department Of Administration, Ocs Office, Moffitt; County Of San Luis Obispo, California, Air Pollution Control District, Carr; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Environmental Center, San Luis Obispo County, California, Kupper; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Stevens & 48 Signatories; New Orleans, LA Public Hearing, Testimony; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

An analysis of the effect which OCS development has had on the socioeconomic well-being of affected communities is relevant in the EIS to the extent that it may provide information for an assessment of potential future impacts. The data available on this subject have been reviewed and used, as appropriate, in the analysis of potential future impacts. An extensive and detailed analysis or description of past OCS-related socioeconomic impacts is not required for the Comprehensive Program EIS in order to estimate potential impacts of the proposed program.

Several studies are planned, in-progress, or near completion to obtain more information on the impacts of OCS-related activities on the coastal communities. These MMS initiatives include a Study of the Impacts of Offshore Oil Exploration and Production on the Social Institutions of Coastal Louisiana which is at the draft report stage, and a Conference on the Impacts of Offshore Oil Production on Gulf Coast Communities which is scheduled for the Fall of 1992. Three studies in the social and economic studies series have been proposed for funding in Fiscal Year 1993 for the Gulf of Mexico. These studies are entitled: (1) *A Comprehensive Assessment of the Historical Socioeconomic Impacts of OCS Development in the Gulf of Mexico*, (2) *Gulf of Mexico Social/Economic Study*, and (3) *Modeling the Socioeconomic Impacts of OCS Development on Coastal Areas in the Gulf of Mexico*. A number of additional studies have been recently completed to improve the socioeconomic information base. These include a Study of the Socioeconomic Impacts of Declining Oil and Gas Activity in the Gulf of Mexico, a Study of the Impacts of Oil and Gas

Development on Recreation and Tourism Off the Florida Straits, and a Study of the Environmental Costs of OCS Oil and Gas Development and Marine Oil Spills. MMS has funded several studies which provide socioeconomic profiles of every county in California. Some of these studies are "*Economic and Demographic Profile of San Luis Obispo County*" (OCS Study MMS 85-0015), "*Baseline Socioeconomic Profiles of Coastal Counties in the California Planning Areas*" (OCS Study MMS 87-0052, -0053 and -0054) and "*Cumulative Socioeconomic Impacts of Oil and Gas Development in the Santa Barbara Channel Region: A Case Study*" (OCS Study MMS 84-0059). These references have been added to Chapter III. Additional socioeconomic studies are expected to be funded in the next few years. Numerous socioeconomic studies have been executed in the Alaska Region dealing particularly with native populations. As it becomes available, all new information will be used in the EIS analysis of potential impacts to coastal communities from OCS-related activities.

The draft EIS adequately estimated potential impacts to employment and demography based on the assumptions and scenario included in the proposed program. However, changes have been made in the final EIS which address the lack of socioeconomic impact analysis in the Gulf of Mexico Region. Specifically, two new sections (one on public services and community infrastructure and the other on social patterns) expand the analysis of socioeconomic effects of the proposal. Impacts on community structure, public services, infrastructure, traditional cultures and traditional occupations are examined in the analysis.

There is much literature documenting the "boom-bust" cycle of natural resource exploitation. An analysis of socioeconomic impacts associated with this phenomenon will be included in the Proposed Comprehensive Program Secretarial Issue Document (SID). The ability of regional and local communities to adapt to OCS-related demands is primarily a function of the time span over which the cycle occurs. In the case of commercial Gulf of Mexico offshore oil and gas activity, in general, the overall cycle began in 1947. Despite recent price-related downturns, the long term "bust" which is based on resource depletion has neither occurred nor is expected to occur in the near future. In the short-term, communities may be stressed to adapt to significant changes in OCS-related demand. While this was more difficult to predict and manage in the past, experience, research, and related improvements in the planning process at regional and local levels have already provided a satisfactory framework for proper coastal zone management. A key factor in the success of this process is the permit authority of Louisiana over all OCS postlease activities which affect its coast. Parishes and counties in the Gulf of Mexico Region which are heavily dependent on OCS oil and gas activity will likely diversify their economies over the next twenty years. In fact, there have already been numerous and significant efforts to diversify the Gulf State economies. A diversified economy will provide the coastal communities the opportunity to achieve net economic growth in spite of the long-term downturn in the oil and gas industry.

ISSUE 39. Impacts on Land Use.

a. Definition of Issue

The Executive Summary of the draft EIS states that "No substantive land use impacts are expected to result from implementing the proposed action in the Atlantic, Pacific or Gulf of Mexico Regions." One commenter interpreted this to suggest that OCS activity does not have direct land use impacts and noted that this is "incorrect and very misleading" and that the draft EIS failed to address onshore land use impacts. Another commenter asserted that the EIS must contain a discussion of the permitting and acquisition process for pipeline rights-of-way and onshore processing plants. A third commenter questioned the need for additional leasing off the Atlantic coast since, as noted in the draft EIS, existing oil and gas exploration and production capacity is significantly underutilized.

b. Issue Was Raised by

Port San Luis Harbor District, California, Moffitt; State Of California, Washington Office Of The Governor, Wilson; State Of Maryland, Department Of The Environment, Scotto; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; City Of El Segundo, California, Morries; City Of Monterey, California, Community Development, Wojtkowski; City Of Santa Barbara, California, Brown; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; ECO SLO, California, Kupper; Port San Luis Harbor District, Ca, Board Of Commissioners, Leane; Bering Straits Native Corporation, Alaska, Martin; League Of Women Voters, California, Fuller; Sierra Club, National OCS Subcommittee, Taylor; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The executive summary is prepared to inform and assist in decisionmaking for a *national* program with leasing over a five year period and activities extending for 30 years or more. The statement about land use impacts in the executive summary was made within that context. Nonetheless, that section has been revised to acknowledge the potential for local impacts. Local impacts are also examined in some detail for the regions in Section IV.D of the document. Because of the scenario assumption that, at least for the Atlantic, the Gulf of Mexico, and the Pacific, existing facilities will be adequate to handle OCS production resulting from this proposed program, land use impacts should be *de minimus*.

The proposed action examined in this EIS is the execution of a leasing program pursuant to the OCS Lands Act, not action to grant permits or acquire lands. While the document does contain some discussion of these processes, other documents, rather than this EIS are more appropriate for a thorough treatment of the subject matter. These include the various state coastal zone management program documents and, more generally the work of the New England River Basins Commission (1978). In addition, one of the best summary documents addressing the topic was prepared by the North Carolina Department of Natural Resources and Community Development through the Coastal Energy Impact Program. It is entitled *Outer Continental Shelf Development and the North Carolina Coast: A Guide for Local Planners* (CEIP Report No. 5), dated August, 1981.

Regarding the comment about leasing in the Atlantic, the need to conduct a leasing program has been determined by law (the OCS Lands Act) to fulfill objectives relating to national energy needs. The level of OCS activity is not determined by existing exploration and production capabilities.

ISSUE 40. Impacts on Transportation.

a. Definition of Issue

The commenters listed below noted that the draft EIS failed to adequately consider, among other things navigation and existing or proposed sealanes.

b. Issue Was Raised by

U.S. Dept. Of The Interior, National Park Service, Galvin; State Of California, Department Of Transportation, Joseph; City Of Laguna Beach, California, Mayor, Fitzpatrick; City Of Morro Bay, California, Mayor, Sheetz; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; San Luis Obispo Area Coord. Council, Regional Transportation Planning Agency, Rappa; Public Awareness Committee For The Env., Alaska, Garoutte/Winder; Sierra Club, Legal Defense Fund, Inc., Briggs; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The subjects of vessel traffic, traffic management, ports, transportation networks, and physical emplacement of equipment are addressed in several places throughout the document. In particular, Sections III.A.3.a(3), III.B.3.a(3), III.C.3.a(4), III.D.3.a(3), IV.A.1.a, IV.D.1.a(10)(b)3), IV.D.1.a(10)(c)3), and IV.D.1.a(10)(d)3) address these issues. These discussions are supplemented by maps depicting existing and proposed sealanes. These maps will be distributed with this final EIS. The EIS analysis does adequately examine conflicts between oil and gas structures such as rigs, platforms and pipelines, and OCS-related vessels and other marine vessel traffic. The potential for oil spills from navigation hazards is inherent in the statistics generated by the Oil Spill Risk Analysis model which form the basis for oil spill assumptions. The EIS conclusions are based on an analysis using scenarios that assume specific levels of OCS activity, including numbers of structures and support vessel trips. Each successive stage of the process from leasing to production allows for refining assumptions and increasing the specificity of the analysis to ensure that the appropriate amount of information is presented for the decisions being considered.

ISSUE 41. Impacts on Public Services.

a. Definition of Issue

Commenters asserted that the EIS fails to address the long-term secondary impacts to the environment from population gains and infrastructure stresses associated with OCS development.

b. Issue Was Raised by

State Of California, Coastal Commission, Hansch; City Of Santa Barbara, California, Brown; County Of San Luis Obispo, California, Board Of Supervisors, Blakely; County Of Santa Barbara, California, Board Of Supervisors, Owens; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; Coalition To Restore Coastal Louisiana, Kemp; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The level of analysis needed for a programmatic EIS does not require a discrete breakdown of long-term, secondary impacts on public services. As individual projects and activities are proposed and implemented, this kind of detail can be identified and incorporated into the decisionmaking process. At the programmatic level, these kinds of secondary effects are part of the overall assessment of impacts to public services based on the scenario components.

Changes have been made in the final EIS which address the lack of socioeconomic impact analysis in the Gulf of Mexico Region. Specifically, two new sections (one on public services and community infrastructure and the other on social patterns) expand the analysis of socioeconomic effects of the proposal. Impacts on community structure, public services, infrastructure, traditional cultures and traditional occupations are examined in the analysis.

ISSUE 42. Impacts on Subsistence.

a. Definition of Issue

Several comments addressed the treatment of subsistence issues in the Alaska Region. These included comments on the failure to use the most recent information available regarding the effects of the *Exxon Valdez* spill; failure to address the increased dependence on offshore areas in the cumulative case because of onshore industrial development and oil spill-related reduction of subsistence user's federally established harvest quotas; a failure to discuss the mitigation of effects on subsistence given the oil spill assumptions; and a failure to address in detail the anticipated impacts on specific villages dependent upon subsistence resources.

Comments asserted that the EIS wrongly concluded the assumed oil spills would not cause long-term effects on subsistence and that the EIS recognition of the potential for a single or multigenerational decline of subsistence species constituted a "cavalier dismissal" of the proposed action's cultural impacts.

One commenter suggested that the North Slope Borough (NSB) is not "urbanizing" as the EIS states but is "modernizing" instead, upgrading its infrastructure the same way as other rural communities in the lower 48 states. The commenter suggested that the orientation toward "urbanization" implies "a Native people abandoning their traditional culture."

b. Issue Was Raised by

U.S. Dept. Of Health & Human Services, Public Health Service, Holt; State Of Alaska, Div. Of Government Coordination, Rusanowski; North Slope Borough, Alaska, Mayor, Kaleak; Northwest Arctic Borough, Alaska, Greene; Greenpeace, Washington, D.C., Alexander; Kodiak Environmental Network, Alaska, Stahl-Johnson; Anchorage, AK Public Hearing, Testimony.

c. Response to Issue

The information contained in the description of subsistence activities in the EIS was derived from the most recent EIS's and other sources for the various regions of Alaska. Information on the effects of the *Exxon Valdez* oil spill on subsistence is not presented because research on the effects of the spill either is still under way or publication of the results of studies was still constrained by litigation at the time the EIS was completed. Anecdotal information derived from qualitative investigations and news articles provides useful insights into behavior among selected communities effected by the spill, but the absence of systematic social science research suggests deferment of a description of the effects of the spill on subsistence until the research effort is completed.

Additional information on subsistence whaling quotas has been added to the cumulative case for subsistence. Additional discussion on "the extent to which subsistence users may become more dependent on offshore areas due to onshore industrial developments" has not been included because the proposal is so broad and involves so many variables. Subsistence resource harvests may vary seasonally, but the annual cycle of subsistence resource dependencies largely remains constant over time because of the range of resources supported by the habitat near a given community, within customary travel distances, or available through intervillage sharing networks. The proposal of the commenter seems to assume that onshore industrial developments would reduce the availability, desirability, or relative accessibility of onshore subsistence resources, thus causing subsistence users to depend more on marine resources. A highly urbanized environment may reduce the opportunity to use onshore resources because of resource displacement, but it is just as likely the residents having access to employment opportunities would use the incomes so derived to extend the boundaries of subsistence harvests or intensify the efficiency of the hunt rather than shift resource dependencies. Those without access to such income production may suffer from resource displacement and increase their relative dependency on customarily used marine resources, but it is unlikely there would be any extensive substitution of noncustomarily-harvested marine resources because of the technology required, the lack of a knowledge base to perform the substitution, or the characteristics of the resources in question. So many variables enter such a consideration that a full discussion of all the possible permutations is beyond the scope of this EIS.

Regarding mitigation, the assessed effects are based on an assumption that an oil spill would occur and oil would contact subsistence resources. This was an assumption for NEPA purposes only and does not imply that a spill actually will occur. The best way to mitigate effects on subsistence resources and sociocultural systems is to ensure clean and safe operations—and no spills. The MMS believes our rules and regulations do mitigate the actual risk of spills and subsequent negative effects upon subsistence resources.

The analysis of subsistence in the State of Alaska is appropriate for to the scenario used for the proposal. In most cases, a village-by-village analysis was not appropriate because the conditions provided for analysis purposes either were not site specific (such as the location of shore bases or the specific trajectory of oil spills) or season specific. Analysis of impacts on biological populations may be appropriate at this level of generality. However, analysis of specific harvesting patterns relative to the availability of or accessibility to biological subsistence resources is limited where specific harvest patterns would be affected by specific effects on biological habitats and specific subgroups of biological resources. A more detailed analysis of subsistence harvest patterns would not be supported by the factors at hand without this level of biological specificity. A more detailed analysis will be done in the sale-specific EIS's.

The analysis of impacts on Alaskan subsistence in the base case (see Section IV.D.1.a) includes one 25,000-bbl pipeline spill in the Beaufort Sea, two pipeline spills and one 20,000-bbl platform spill in the Chukchi Sea, one tanker spill of 30,000 bbl in the Gulf of Alaska from oil transported out of the Alyeska terminal in Valdez (three other tankers with Arctic crude are assumed to create spills elsewhere along the shipping route), one additional tanker spill in Prince William Sound or the Gulf of Alaska as a result of operations in the Gulf of Alaska, a pipeline spill in the Gulf of Alaska off Yakutat, and two spills of 1,000 bbl or greater in the St. George and Navarin Basins. Spills of 10,000 bbl or greater are included in the set of spills of 1,000 bbl or greater. The comment that the EIS claims that the base case of the proposal "would not cause significant long-term impacts on subsistence patterns" is not accurate. The conclusion states "one or more important subsistence resources are expected to become unavailable, undesirable for use, or available only in greatly reduced numbers for one or more periods of 1 to 2 years during the life of the proposed leases in the Arctic." This conclusion is far from being insignificant, and effects would be compounded if more than one spill occurred in a given year.

There is no intent to imply that hunting/fishing/gathering would cease until the populations of affected subsistence resources reached preincident levels. Subsistence harvesting is on one hand predictable because of the known range of resources available for harvest throughout the year but on the other hand is opportunistic as well, in as much as fish and wildlife populations undergo natural population-level fluctuations. As a result, a certain amount of resource substitution would be expected to take place if a given subsistence resource were to decline in population level or accessibility. Limits to substitution obviously exist, not only within the range of resources available to a community but also in the relative numbers and effort involved to perform such substitution (as with birds for walrus). The product of the substitution and the activity patterns needed to perform the substitutions also may not have the same material or cultural significance as the previously harvested subsistence resource.

A visitor to the North Slope sees that NSB Inupiat are not abandoning their traditional subsistence-oriented culture, although it is plain that their material culture has been substantially altered, as has been the case elsewhere in rural Alaska as well. This change in material culture (new homes, bus systems, senior citizen housing and services, modern education facilities, satellite television reception, supermarkets, sewer and water systems, police and fire protection, etc.) is part of urbanization, where interdependencies and dependencies are established within a system of service-providing centers (cities) that modify (and sometimes modify substantially) the real or hoped for self-sufficiency of the unchanging and traditional value-laden village. The village still exists on the North Slope, but with a modern facade. To call this "modernization" rather than "urbanization" is simply a preference for terms. The urbanist, however, also uses the term "urbanism," which means the cosmopolitan way of life that goes along with modern things. One could argue that the term "modernization" combines both urbanization and urbanism, but to do so would be simply a play on words. The term "urbanization" was not used to mean cultural assimilation, as suggested by the commenter.

ISSUE 43. Impacts on Human Behavior and Activity.

a. Definition of Issue

The National Academy of Sciences (NAS) in its report for the President's Task Force on OCS Leasing and Development (1989), noted that "certain types" of impacts are not even addressed in offshore oil and gas EISs. To begin to address this perceived deficiency, the MMS has included a discussion of "Human Behavior and Activity" categorized into "political," "economic" and "social dysfunction" impacts and their potential causes. Customarily, discussion of such impacts has been excluded from EIS analysis.

Comments on the EIS discussion of this topic cover the full spectrum of possible responses. Some commenters noted that it is "very interesting," a subject that "everyone in government needs to understand better," and that it should be "amplified." Conversely, others commented that it is an attempt to "discredit opposition" to the OCS program and the discussion should be eliminated from the document.

Some commenters noted that if the discussion remains in the final EIS it should acknowledge the "deficiencies in past analyses" and identify the current data gaps and how MMS is attempting to fill them. On the other hand, some commenters noted that the discussion should reflect "both sides" of the issue, recognizing the social dysfunction occurring because people are out of work as a result of the *lack* of OCS development.

b. Issue Was Raised by

State Of California, Washington Office Of The Governor, Wilson; State Of Louisiana, Department Of Natural Resources, Swan; State Of New York, Department Of Environmental Conservation, Sovas; State Of North Carolina, Department Of Administration, OCS Office, Moffitt; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Unocal 76, North American Oil & Gas Division, Attebery; Santa Maria, CA Public Hearing, Testimony.

c. Response to Issue

The NAS recommendations notwithstanding, it has been argued that the topic of prelease concerns and effects on human behavior are outside the purview of environmental analysis for NEPA. Nonetheless, the MMS is attempting to acknowledge and address, rather than dismiss, the issue. The discussion in the EIS seeks to point out some of the issue's characteristics and provide some analytical structure. This discussion is in no way intended to discredit or dismiss these concerns on the part of the commenters; nor is it intended to claim an exclusive objective viewpoint on the part of the agency. On the contrary, its purpose is to acknowledge and examine the symptoms and their possible causes. Some of the potentially offending language has been removed.

The final EIS still includes the human behavior discussion and the topic is likely to be the subject of fuller examinations over time. The MMS has expended over $26 million in socioeconomic studies. While this NEPA document is not the proper medium for reviewing "deficiencies in past analyses," a variety of studies and other efforts have been undertaken to further address socioeconomic issues relating to offshore oil and gas activities. These efforts are likely to have greater emphasis on human behavior effects.

The discussion in this final EIS does now recognize the potential impacts of curtailed OCS activity, not only in this section but also sections analyzing socioeconomic impacts.

ISSUE 44. Disposal, Behavior, and Effects of Drilling and Production Wastes.

a. Definition of Issue

Several comments were received indicating that additional information needs to be presented in the EIS regarding drilling wastes (e.g., muds and cuttings) and production wastes (e.g., produced water). Specifically, one commenter stated that additional information and special attention is required on the behavior of drilling muds and other discharges dumped into the Beaufort and Chukchi Seas and their impacts on marine subsistence resources. Another commenter indicated that MMS had previously stated that the effects of drilling discharges in deeper depositional environments is unknown, whereas in the present EIS, the discussion (Section IV.A—Generic Impacts on Water Quality) makes it appear that the scientific consensus is that such discharges are not of concern. One commenter inquired as to where the muds and residues from drilling and start-up production in the California OCS will be disposed of. Another asked as to why the Atlantic was used in the presentation of "typical" drilling-rig discharges into offshore waters.

b. Issue Was Raised by

State Of Florida, Office Of The Governor, Chiles; State Of Washington, Office Of The Governor, Booth; Alaska Eskimo Whaling Commission, Rexford; Sierra Club, Delta Chapter, Legal Defense Fund, Inc., Wiygul; Evans.

c. Response to Issue

The nature, disposal, behavior and environmental effects of OCS drilling and production wastes are discussed in a general, yet comprehensive manner, in Section IV.A.1.b (Impacts Associated with Discharges and Emissions). Additionally, the behavior and effects of these discharges and wastes are addressed by resource affected (e.g., water quality) and OCS Region in Section IV.D for the base, high, and cumulative cases. Within this programmatic EIS, there is not a particular focus placed on impacts from drilling muds and other discharges on marine subsistence resources in the Beaufort and Chukchi Seas because this is not perceived to be a substantive environmental problem, based on the literature reviewed. However, disposal procedures and behavior of these materials and their potential environmental effects on water quality and subsistence organisms, such as marine mammals, in Alaska waters is still presented in Sections IV.D.1.a(1) and IV.D.1.a(3). Additional emphasis and information will be presented on these materials and their environmental impacts in sale-specific EIS's, as was done previously for sales in the Beaufort and Chukchi Seas.

It is not inconsistent to have limited knowledge on the effects of drilling discharges in deeper depositional environments and yet have little concern regarding these effects. This is because the information on these discharges, as presented in this EIS, in sale-specific EIS's, and in the available literature, overwhelmingly indicates no substantive environmental problems in other (shallower) environments. Hence, it is reasonable to conclude that such problems, although possible, are unlikely even in a somewhat different marine environment.

Disposal and potential environmental effects of drilling muds and residues from the OCS activity off California are discussed in the EIS. These aspects are considered in some detail under impacts on water quality (Section IV.D.1.a(1)(c)) and seafloor habitats (Section IV.D.1.a(9)(b)). Given that this is a programmatic EIS, the methods and locations of disposal cannot be precisely identified at this time. They will be discussed more precisely and in detail when the sale-specific EIS is prepared and specifically identified during the USEPA permitting (e.g., NPDES discharge permit) stage. This EIS, however, does discuss the possible types of discharges, which range from direct release into adjacent waters, to reinjection, or to barging onshore.

The drilling discharges from the Atlantic (Table IV.A-5) were presented as "typical" because this information was available (from the USEPA source cited) in an easily understandable format and was considered representative for OCS drilling operations. This information was considered appropriate for the Section IV.A (Generic Impacts) type of discussion in the EIS.

ISSUE 45. Impacts Conclusions Were "Averaged."

a. Definition of Issue

Some commenters stated that the draft EIS failed to assess potential impacts on small areas in a meaningful manner because it includes such potential impacts with other impacts for a large area. This "averaging," it was argued, dilutes the impacts of local areas and is misleading. For example, in the Southern California Planning Area, there are 17 assumed spills specifically located in a given area, but the effects of the spill are assessed for the whole planning area.

b. Issue Was Raised by

Port San Luis Harbor District, California, Moffitt; State Of California, Washington Office Of The Governor, Wilson; County Of Santa Barbara, California, Resource Mgt. Dept., Zorovich; League Of Women Voters, California, Fuller.

c. Response to Issue

The EIS does not try to minimize the potential impacts of OCS activities on small areas. The intent of the analyses is to support conclusions regarding reasonably expected levels of impacts to resources at risk on both a local or species-specific level as well as a regional or resource-wide level. For most biological resources, a separate analysis with a conclusion was provided for specific species when that species warranted a separate analysis rather than having a single conclusion for the resource as a whole. For example, conclusions were provided for various species of whales rather than one conclusion for cetaceans.

Where appropriate, the analyses and conclusions differentiate between expected local or regional impacts and between expected resource-wide impacts or species-specific impacts. For example, an analysis may show that the expected impacts to a particular bird species may be high for a given area but for birds as a whole, the impacts are expected to be low. We do not believe this is "averaging" or understating potential impacts. The distinction between expected local or species-specific impacts and regional or resource-wide impacts can and should be made when the information and analysis permit.

The analysis in the EIS is by resource rather than by planning area. This was not done to average impacts, but rather to aid in the decision making process because it is important to determine how a resource, such as the northern fur seal, may be affected overall by the activities assumed for the program. Often the activities cover more than one planning area. If impacts are expected to occur primarily in a particular area, that is brought out in the analysis. The conclusion, however, indicates the expected level of impact on an entire population or species.

The EIS analyses contain both a discussion of possible impacts to which a resource is susceptible as well as a discussion of the anticipated interaction of the resource at risk with impact producing factors. Just because a resource may be sensitive to a certain pollutant or activity does not necessarily mean the expected impact would be great. In reaching a conclusion of the expected impact on a resource, consideration must be given to several factors, including among others, sensitivity, the magnitude and location of assumed OCS activities over the life of the project, and the probability of accidental oil spills and blowouts. The analysis may indicate that the potential impact to a resource could be high, but the conclusion could indicate something considerably less. This would not be the result of "averaging" or combining magnitude and probability. It would be the result of judgment that indicates that although a high impact could occur, a lower impact is expected when all factors are considered.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. Administration.

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